GROUNDWATER QUALITY ASSESSMENT
FOR
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

DECEMBER 1994

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EXECUTIVE SUMMARY

This report presents the results of a Groundwater Quality Assessment conducted at the American Steel Foundries Sebring Facility. The assessment was performed in accordance with the procedures described in the Groundwater Quality Assessment Plan (RMT, 1992) which was approved by the Ohio Environmental Protection Agency.

The purpose of the assessment was to determine whether any chemical constituents have been released from the landfill to groundwater. In order to accomplish this objective, additional groundwater monitoring wells were installed, a description of site geology and hydrogeology was prepared, and four quarters of groundwater quality data were collected. Upgradient and downgradient groundwater quality was compared to determine whether groundwater quality had changed. Based on the results of this comparison, an enhanced groundwater monitoring program was developed.

The landfill is located within a former strip mine. After the strip mine ceased operation, foundry waste was placed in the excavation. Mine spoils are present on the site, primarily along the northern, southern, and western perimeters of the landfill. The naturally occurring geologic deposits consist of alternating layers of sandstone and shale with coal and underclay. The uppermost aquifer is the Clarion shale. Groundwater flow is generally toward the west.

A statistical evaluation of groundwater quality data was performed using both the tolerance interval method and, for parameters with a large proportion of "non-detects", the test of proportions. Separate statistical evaluations were performed for wells screened in the shale and for wells screened in the spoils. Because spoils are not present upgradient of the landfill, a sidegradient spoils well was chosen to develop tolerance intervals for spoils wells. The results of the statistical evaluation for spoils wells may not be statistically significant because of the limited available sidegradient data.

The statistical comparison indicates that bicarbonate alkalinity, barium, fluoride, sodium, total organic carbon, and manganese are statistically different in downgradient shale wells compared to upgradient shale wells.

As a result of activities conducted during 1994, an enhanced groundwater monitoring program was developed. The program includes the addition of four groundwater monitoring wells screened in the uppermost aquifer, the Clarion Shale. Semiannual groundwater sampling and reporting will be performed to monitor groundwater flow and quality.

Section 1
INTRODUCTION

This report presents the results of the Groundwater Quality Assessment conducted at the American Steel Foundries (ASF) Alliance, Ohio Sebring facility (landfill).

1.1 Background

The landfill, shown on Figure 1, has been in operation for over 20 years as a disposal site for typical foundry wastes from the Sebring facility, including foundry sand, refractories, slag material, and sludge from the sand washers and wet dust collectors.

The possibility exists that, during the past 20 years, hazardous electric arc furnace baghouse dust was intermixed with typical foundry waste and deposited in the landfill. To assess the possibility that hazardous materials were placed in the landfill and may have impacted the groundwater quality, ASF has agreed, as part of a consent decree, to perform a groundwater quality assessment of the site under RCRA 40 CFR Part 265 Subpart F, and Ohio Administrative Code (OAC) 3745-65, et seq.

1.2 Purpose and Scope

The purpose of this investigation was to determine if releases of hazardous waste or hazardous waste constituents from the landfill to groundwater have occurred. The investigation was conducted in accordance with the Groundwater Quality Assessment Plan (RMT, 1992). The scope of the investigation included the following:

- Installation of additional groundwater monitoring wells.
- Sampling site groundwater monitoring wells on a quarterly basis for a period of one year.
- Preparing quarterly reports and submitting them to the OEPA.
- Summarizing site hydrogeologic data.
- Performing a statistical evaluation of groundwater quality.
- Preparing a long-term groundwater monitoring plan.

Section 2
WORK PERFORMED

The field investigation consisted of installation of eight additional groundwater monitoring wells and sampling of monitoring wells during four quarters.

2.1 Monitoring Well Installation

Monitoring wells MW-19, MW-19P, MW-21, MW-21P, MW-22, MW-22P, MW-23, and MW-23P were installed in November 1993 by Summit Drilling under the supervision of RMT. Wells were constructed using procedures outlined in the Groundwater Sampling Plan (RMT, 1992). Drilling logs and well construction details for these wells are presented in Appendices A and B, respectively. Drilling logs and well construction details for all other wells were presented in the Groundwater Quality Assessment Plan (RMT, 1992). Well construction information for all site monitoring wells is presented in Table 1. Well locations are shown in Figure 1.

2.2 Groundwater Sampling

Groundwater sampling was conducted in December 1993 and March, June, and September, 1994. The Groundwater Quality Assessment Plan (Plan) required that during the first quarterly sampling wells MW-1A, MW-4A, MW-13, MW-14, MW-19, MW-19P, MW-20, MW-21, MW-21P, MW-22, MW-22P, and MW-23 be sampled and analyzed for the following:

- Water quality and indicator parameters (Table 3-1 of the Plan).
- Volatile organic compounds (Table 3-2 of the Plan).
- Appendix IX Metals (Table 3-3 of the Plan).

During the second, third, and fourth quarter monitoring, the following parameters were analyzed:

- Water quality and indicator parameters (Table 3-1 of the Plan).
- Selected Appendix IX metals which were detected above the Practical Quantitation Limits (PQLs) (Table 3-3 of the Plan, revised).
- Compounds found in the ASF waste stream (Table 3-5 of the Plan).

The selected Appendix IX metals list excludes the following compounds that were not detected above the PQL and that are not on Table 3-5 of the Plan: beryllium, cyanide, thallium, and vanadium. Copies of Tables 3-1, 3-2, 3-3, 3-5, from the Plan and Table 3-3 (revised after the first quarter monitoring) are presented in Appendix C.

Well MW-19P produces very little water and recovers very slowly. As a result, samples were not collected from this well during the second and fourth quarters. Bicarbonate alkalinity was not analyzed for the fourth quarter because of a laboratory oversight.

Section 3
SITE CONDITIONS

3.1 Geology

The landfill is located within a former strip-mine pit. The Middle Kittanning No.6 and Lower Kittanning No.5 coal beds were strip mined in addition to the Lower Kittanning Underclay and some of the softer shale beneath it. Subsequently, foundry waste was placed in the excavation created by the strip mine.

Based on a stratigraphic section measured at the site, the strata adjacent to the facility are composed primarily of alternating thick and thin layers of sandstone and shale with varying thicknesses of coal and underclay. The uppermost aquifer in the vicinity of the site is the Clarion Shale which is the unit underlying the coal beds that were mined at the site.

Geologic cross sections were constructed to illustrate site conditions. Cross section locations are shown on Figure 1. Geologic cross section A-A′ (Figure 2) runs along the western perimeter (downgradient perimeter of the landfill with respect to groundwater flow). Geologic cross sections B-B′ and C-C′ (Figure 2) run from east to west (from upgradient to downgradient) through the landfill.

Bedrock crops out on the east side of the landfill and consists of thin interbeds of siltstone, shale and sandstone. Secondary permeability is likely to occur in fractures and along bedding planes in this generally fine-grained sequence of sedimentary rock.

Mine spoils are present in the vicinity of the landfill, primarily along the northern, western and southern borders of the landfill. The spoils material is generally fine-grained. Gravel and cobble sized material found in the spoils usually consists of shale or siltstone bedrock fragments. The thickness of the spoils along the western side of the landfill ranges from approximately 11 feet (well MW-20) to 43 feet (well MW-22P). Based on existing borings, spoils are present along the entire western perimeter of the landfill. The thickest spoils are likely in the northwest corner of the site.

Foundry wastes, including foundry sand, range in texture from poorly graded silty sand to clay. The foundry waste is more than 45 feet thick in the center of the landfill. The foundry waste appears to be in contact with spoils and the Clarion Shale along the western perimeter of the landfill (See Figure 2)

3.2 Hydrogeology

The uppermost aquifer at the site is the Clarion Shale. Groundwater measurements were collected concurrently with groundwater sampling and are presented on Table 2. Water table maps, showing the direction of groundwater flow during the third and fourth quarters respectively, are presented on Figures 3 and 4.

Groundwater flow direction is generally toward the west. The horizontal hydraulic gradient is steeper in the eastern portion of the property (approximately 0.02) compared to the western portion of the property (approximately 0.001). The water table occurs in the shale (wells MW-19 and MW-14) or the underclay (well MW-1A) upgradient of the landfill. Downgradient of the landfill, the water table occurs in the spoils, with the exception of well MW-20 (See geologic cross sections B-B′ and C-C′ on Figure 2).

Vertical gradients were calculated for the well nests and are presented in Table 3. Vertical gradients vary seasonally at well nests MW-1A/MW-1 and MW-4A/MW-4: Gradients are upward during the winter and early spring months and downward (groundwater recharge conditions) during the summer months. The vertical gradient at well nest MW-19/MW-19P is strongly downward, probably a result of the low hydraulic conductivity of the shale. Vertical gradients were consistently downward at well nest MW-21/MW-21P and upward at well nest MW-22/MW-22P.

3.3 Description of Current Groundwater Monitoring Program

The current groundwater monitoring well network is summarized on Table 4. Screen depths are presented on Table 1. The depths of screened intervals are illustrated on the geologic cross sections, Figure 2. This program was originally presented in the Groundwater Assessment Plan (RMT, 1992) and was approved by the Ohio Environmental Protection Agency.

There are four upgradient wells each screened in the shale. There are seven downgradient wells, three screened in the shale and four screened in the spoils. As indicated in Section 2.2, with one exception, the water table is present in the spoils downgradient of the landfill. There are no upgradient wells screened in spoils because spoils were not encountered upgradient of the landfill. Well MW-23 a sidegradient well and is screened in spoils.

Groundwater quality samples were collected during four quarterly events performed during the period December 1993 through September 1994. Well MW-19P produces very little water and recovers very slowly. As a result, samples were not collected from this well during the second and fourth quarters. The discussion of groundwater quality presented in this report is based on the results of this sampling. Analytical results from the first three quarters were presented in previous reports. Analytical results from the fourth quarter sampling are presented in Appendix D.

3.4 Results of Statistical Analysis of Groundwater Quality Data

Statistical methods were used to compare upgradient monitoring well data with downgradient monitoring well data. This comparison was made to assess whether the landfill was affecting groundwater quality. The statistical methods and results are discussed in the following paragraphs.

3.4.1 Statistical Methods

A tolerance interval approach was used to compare background monitoring well data to downgradient monitoring well data. A tolerance interval is constructed from the data collected from unaffected upgradient background wells. The tolerance interval is constructed by first calculating the mean upgradient concentration of each parameter using all available upgradient data points. Then an interval above and below the mean is created based on the variability of the background data. The upper tolerance limit is calculated as follows:

$$TL = X + K \times S$$

where:

TL is the upper tolerance limit

X is the mean

K is the tolerance factor determine from Table 5, Appendix E, and is based on the number of samples (n)

S is the standard deration

A more detailed description of the statistical procedure and calculations is presented in Appendix E. In the case of several parameters, the measured parameter concentration was below the detection limit. For parameters where the percentage of non-detects was between 0% and 50%, the tolerance interval approach was used and the detection limit was substituted for non-detect values.

In the case of all parameters except pH, an upper tolerance interval was calculated and compared to the actual value for a specific downgradient well. For pH, both upper and lower tolerance intervals were calculated.

For parameters where the percentage of non-detects exceeded 50%, the tolerance interval approach is not appropriate and a test of proportions was used. The test of proportions is a method to determine whether a difference in the proportion of detected values in the background well data compared to the downgradient well data provides statistically significant evidence of impact. The procedure is described in Appendix E.

Each of the statistical methods used here is described in the U.S. EPA publication "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (U.S. EPA, 1989).

Statistical comparisons of upgradient and downgradient groundwater quality were performed for the following parameters using the method indicated.

Tolerance Interval Method	**Test of Proportions Method**
Chloride	Arsenic
Specific Conductance	Cadmium
Manganese	Cobalt
Sodium	Copper
Sulfate	Nickel
Sulfide	Zinc
Total Organic Carbon	Bicarbonate Alkalinity
Total Organic Halides	Carbonate Alkalinity
pH	Antimony
Fluoride	Barium
Iron	

Tolerance Interval Method

Nitrogen Nitrate

Phenolics

Volatile organic compounds (VOCs) were analyzed during the first quarterly sampling round. No VOCs were detected with the exception of chloroform at upgradient well MW-19P. VOCs were not analyzed during subsequent rounds and therefore no statistical analysis was performed.

The following inorganic parameters analyzed during the first round did not exceed the Practical Quantitation Limit (PQL) and were therefore not analyzed during subsequent rounds: beryllium, cyanide, thallium, and vanadium. No statistical analysis was performed for these parameters.

The following parameters were analyzed for during all quarters and did not exceed the detection limit in upgradient or downgradient wells during any of the sampling rounds: lead, mercury, selenium, silver, and tin. No statistical analysis was performed for these parameters.

3.4.2 Results of Statistical Analysis

As indicated previously, monitoring wells at the site are screened either in the spoils or the shale. Each of these two units is characterized by different groundwater chemistry. Therefore independent statistical comparisons were made for wells screened in the shale and for wells screened in the spoils. As indicated on Table 4, there are four upgradient shale wells (MW-1A, MW-14, MW-19, and MW-19P).

There is only one sidegradient well screened in the spoils (MW-23) and no spoils wells located directly upgradient. While there is sufficient upgradient data to calculate tolerance intervals for shale wells, there is limited upgradient data (3 to 4 data points per parameter) to calculate tolerance intervals for spoils wells. Regardless, tolerance intervals were calculated based on results from well MW-23. However, the results of the statistical comparison of spoils wells are likely not conclusive because of the limited upgradient data and should be reevaluated based on 1995 monitoring results. In addition, the spoils piles are a result of mining activity and there could be substantial variability in the chemical characteristics of the spoils from location to location. Conclusions regarding potential groundwater impact in spoils wells as a result of landfill operations should not be made based on this analysis.

Tolerance intervals were calculated based on data from upgradient shale wells and are presented on Table E1, Appendix E. The comparison between observed downgradient constituent concentrations and the tolerance intervals for shale wells is presented in Table E2, Appendix E. Table E2 also presents the results of the test of proportions.

Tolerance intervals based on data from the sidegradient spoils well are presented on Table E3, Appendix E. The comparison between observed downgradient constituent concentrations and the tolerance intervals for spoils wells is presented in Table E4, Appendix E.

Summaries of tolerance interval exceedances for shale wells and spoils wells are presented in Tables 5 and 6, respectively. A discussion of the results of the statistical evaluation follows.

Bicarbonate Alkalinity

A tolerance interval for bicarbonate alkalinity in shale wells was not calculated because there were only three upgradient detects in shale wells. There were 8 downgradient detects in shale wells. The results of the test of proportions suggests that there is a significant difference between upgradient and downgradient bicarbonate alkalinity in the shale.

Carbonate Alkalinity

Carbonate alkalinity concentrations at spoils wells MW-4A, MW-21, and MW-22 exceeded the tolerance interval on one occasion at each well.

Barium

A tolerance interval for barium was not calculated because there were no upgradient detects in shale wells. There were 8 downgradient detects. The results of the test of proportions suggests that there is a significant difference between upgradient and downgradient barium concentrations in the shale. Downgradient concentrations ranged from 110 ug/L to 240 ug/L, below the U.S. EPA maximum contaminant level (MCL) of 1,000 ug/L.

Fluoride

Fluoride concentrations at downgradient shale wells MW-21P and MW-22P exceeded the tolerance interval at each well on all four sampling dates. Fluoride concentrations at well MW-21P ranged from 2.9 to 3.6 mg/L and fluoride concentrations at well MW-22P ranged from 9 to 10 mg/L. The MCL is 4 mg/L.

Fluoride concentrations at downgradient spoils wells MW-13, MW-21 and MW-22 also exceeded the tolerance interval established using sidegradient well MW-23.

Sodium

The sodium concentration at downgradient shale wells MW-21P and MW-22P exceeded the tolerance interval at each well on three occasions and four occasions, respectively. The sodium concentration at downgradient spoils well MW-21 exceeded the tolerance interval established using sidegradient well MW-23 on four occasions.

Total Organic Carbon

The total organic carbon (TOC) concentration at downgradient shale well MW-21P exceeded the tolerance interval on one occasion. The TOC concentration at downgradient spoils well MW-4A, MW-13, MW-21, and MW-22 exceeded the tolerance interval established using sidegradient well MW-23 on four occasions.

Total Organic Halides

The total organic halide (TOX) concentration at shale well MW-21P exceeded the tolerance interval on one occasion.

Manganese

The manganese concentration at downgradient shale well MW-20 exceeded the tolerance interval on three occasions. The manganese concentration at downgradient spoils wells MW-4A, MW-13, MW-21 and MW-22 exceeded the tolerance interval established using sidegradient well MW-23. Concentrations ranged from 7,800 to 15,000 ug/L. The secondary drinking water MCL is 50 ug/L.

Zinc

The zinc concentration at downgradient spoils well MW-13 exceeded the tolerance interval established using sidegradient well MW-23 on four occasions. Concentrations ranged from 230 to 370 ug/L. The secondary drinking water MCL is 5,000 ug/L.

In summary, it appears that bicarbonate alkalinity, barium, fluoride, sodium, TOC, TOX and manganese concentrations are statistically different in certain downgradient shale wells compared to upgradient shale wells. Zinc, carbonate alkalinity, fluoride, sodium, TOC and manganese concentrations in several spoils well appear to be statistically different than sidegradient spoils well MW-23. However, this conclusion is based on limited data and because of the substantial potential natural variability of geochemistry in these mine spoils piles, comparison of groundwater quality data from spoils wells may not be appropriate.

Section 4

PROPOSED GROUNDWATER MONITORING SYSTEM

Based on the results of the four quarters of groundwater monitoring, it appears that there are some differences between upgradient and downgradient concentrations for certain parameters. In order to better evaluate these, several modifications to the monitoring program are being recommended. Several additional groundwater monitoring wells are proposed to create better horizontal and vertical coverage of the area downgradient of the landfill. The addition of these wells is consistent with the discussions which occurred between ASF and OEPA during the July 25, 1994 meeting. A summary of the revised monitoring program is presented in Table 7 and a brief description of the program follows.

Each of the proposed monitoring wells will be screened within the uppermost aquifer, the Clarion Shale. Well MW-24 will be installed midway between existing well MW-20 and existing wells MW-21/MW-21P. Well MW-25 will be installed midway between existing wells MW-21/MW-21P and existing wells MW-22/MW-22P. With the addition of these two wells there should be good coverage of the entire western (downgradient) border of the landfill.

Additional wells screened in the shale, MW-12P and MW-13P, are proposed at the existing well MW-12, and MW-13 locations, respectively. Well MW-12P will monitor groundwater leaving toward the southwest of the landfill and also may monitor potential affects from the Pond. Well MW-12 will be monitored for water levels but not water quality. Well MW-13P will monitor groundwater in the shale downgradient of the northern portion of the landill.

No additional wells are proposed to be installed in the spoils because it appears that there is substantial natural variability in the geochemistry of the spoils. In addition, the spoils are not present upgradient of the landfill, making it impossible to perform true upgradient/downgradient comparisons. Monitoring the existing monitoring wells screened in the spoils should be sufficient.

The parameters to be analyzed have been modified as a result of observations made during the past four quarterly samplings. The revised parameter list consists of metals and the field indicator parameters pH, specific conductance, and temperature. Eight parameters were either not detected (mercury, selenium, silver, tin, and lead) or detected only several times (carbonate alkalinity, copper, and chromium), during the past four quarters. Tin, copper, carbonate alkalinity, bicarbonate alkalinity, sulfide, total organic carbon, total organic halides, and sodium are not related to the ASF Sebring Facility waste stream (See Appendix C, Table 3-5) and have therefore been eliminated from the program. Nitrate nitrogen is also unrelated to the ASF waste and has been eliminated. No statistical exceedances for chloride and sulfate were noted during 1994 monitoring and these parameters have therefore been eliminated. Sampling will be conducted on a semi-annual basis. Mercury, selenium, silver, lead, and chromium were present in the ASF waste stream but were not detected or were detected infrequently and will therefore be analyzed on an annual basis.

Iron and manganese concentrations may be indicative of impacts from previous mining operations. These parameters have been retained in the program, but results of these analyses will be evaluated in light of previous mining operations.

Table 1
SUMMARY OF MONITORING WELL CONSTRUCTION INFORMATION
ASF SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Well Number	Top of Casing Elevation (feet, MSL)	Ground Elevation (feet, MSL)	Original Well Depth (feet)	Measured Well Depth(1)	Screened Interval (depth in feet)			Screened Interval (elevation in feet)			Formation Well Is Screened In	Groundwater Elevation (2) (feet, MSL)
MW-1	1126.73	1124.2	52	51.1	44.5	to	49.5	1074.7	to	1079.7	Shale	1091.20
MW-1A	1126.09	1123.9	42.2	42.4	30	to	40	1083.9	to	1093.9	Shale	1091.56
MW-2	1101.96	1100.3	36.1	36.6	29.1	to	34.1	1066.2	to	1071.2	Spoils	1076.94
MW-3	1093.14	1091.2	27	26.6	19.8	to	24.8	1066.4	to	1071.4	Spoils	1076.89
MW-4	1085.13	1082.6	32.5	32.2	25	to	30	1052.6	to	1057.6	Spoils	1076.63
MW-4A	1085.2	1082.8	16.9	17.5	4.5	to	14.5	1068.3	to	1078.3	Spoils/Foundry Sand	1076.61
MW-12	1087.94	1085.6	37.3	37.4	25	to	35	1050.6	to	1060.6	Sand and Spoils	1077.63
MW-13	1107.70	1106.2	39.5	39.2	28	to	38	1068.2	to	1078.2	Spoils	1079.10
MW-14	1131.18	1128.9	61.8	61.9	49.5	to	59.5	1069.4	to	1079.4	Shale	1080.58
MW-19	1141.16	1138.7	34.5	34.3	22	to	32	1106.7	to	1116.7	Shale	1113.45
MW-19P	1141.36	1138.9	106.5	108.6	99	to	104	1034.9	to	1039.9	Shale	1039.07
MW-20	1113.21	1110.7	41.5	41.3	29	to	39	1071.7	to	1081.7	Shale	1079.31
MW-21	1101.12	1098.6	32.5	32.4	20	to	30	1068.6	to	1078.6	Spoils	1078.56
MW-21P	1100.17	1097.7	67.5	68.4	60	to	65	1032.7	to	1037.7	Shale	1077.42
MW-22	1091.01	1088.5	24.5	22.0	10	to	20	1068.5	to	1078.5	Spoils	1077.18
MW-22P	1091.23	1088.7	67.5	67.0	60	to	65	1023.7	to	1028.7	Shale	1071.83
MW-23	1107.81	1105.3	28.5	27.5	16	to	26	1079.3	to	1089.3	Spoils	1088.74

(1) Depth measured from top of casing by RMT on September 15, 1994
(2) Water levels from June 15, 16, and 17, 1994

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Table 2

GROUNDWATER ELEVATIONS
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Well Designation	Geologic Material	Top of Casing Elevation	December 14-17, 1993		March 15-16, 1994		June 15-17, 1994		September 13-15, 1994	
			Depth to Water	Groundwater Elevation	Depth to Water	Groundwater Elevation	Depth to Water	Groundwater Elevation	Depth to Water	Groundwater Elevation
MW-1	Shale	1126.73	34.11	1092.62	34.45	1092.28	35.53	1091.20	35.27	1091.46
MW-1A	Shale	1126.09	34.66	1091.43	33.89	1092.20	34.53	1091.56	34.61	1091.48
MW-2	Shale	1101.96	24.32	1076.64	23.42	1078.54	25.02	1076.94	25.00	1076.96
MW-3	Spoils	1093.14	15.53	1076.61	14.62	1078.52	16.23	1076.89	16.30	1076.84
MW-4	Spoils	1085.13	7.90	1077.23	7.07	1078.06	8.50	1076.63	8.40	1076.73
MW-4A	Spoils	1085.20	8.05	1077.15	7.68	1077.52	8.59	1076.61	8.48	1076.72
MW-12	Sand and Spoils	1087.94	9.69	1078.25	9.05	1078.89	10.31	1077.63	10.14	1077.80
MW-13	Spoils	1107.70	27.21	1080.49	24.60	1083.10	28.60	1079.10	29.19	1078.51
MW-14	Shale	1131.18	49.52	1081.66	48.70	1082.48	50.60	1080.58	50.64	1080.54
MW-19	Bedrock	1141.16	27.64	1113.52	25.83	1115.33	27.71	1113.45	28.40	1112.76
MW-19P	Bedrock	1141.36	66.24	1075.12	103.12	1038.24	102.29	1039.07	102.90	1038.46
MW-20	Bedrock	1113.21	41.48	1071.73	29.81	1083.40	33.90	1079.31	34.45	1078.76
MW-21	Spoils	1101.12	21.82	1079.30	20.86	1080.26	22.56	1078.56	23.00	1078.12
MW-21P	Bedrock	1100.17	21.92	1078.25	20.77	1079.40	22.75	1077.42	21.60	1078.57
MW-22	Spoils	1091.01	13.18	1077.83	12.27	1078.74	13.83	1077.18	13.81	1077.20
MW-22P	Bedrock	1091.23	19.60	1071.63	18.63	1072.60	19.40	1071.83	20.03	1071.20
MW-23	Spoils	1107.81	18.16	1089.65	18.75	1089.06	19.07	1088.74	19.21	1088.60

Table 3
VERTICAL GROUNDWATER GRADIENTS
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Well Nest	Formation Well Is Screened In	12/14-17/93 Groundwater Elevation	12/14-17/93 Vertical Gradient	3/15-16/94 Groundwater Elevation	3/15-16/94 Vertical Gradient	6/15-17/94 Groundwater Elevation	6/15-17/94 Vertical Gradient	9/13-15/94 Groundwater Elevation	9/13-15/94 Vertical Gradient
MW-1A	Shale	1091.43	-0.0836	1092.2	-0.0053	1091.56	0.0251	1091.48	0.0014
MW-1	Shale	1092.62	(1,2)	1092.28		1091.2		1091.46	
MW-4A	Spoils\Foundry Sand	1077.15	-0.0036	1077.52	-0.0241	1076.61	0.0130	1076.72	-0.0005
MW-4	Spoils	1077.23		1078.06		1076.33		1076.73	
MW-19	Shale	1113.52	0.5168	1115.33	1.0376	1113.45	1.0011	1112.76	1.0000
MW-19P	Shale	1075.12	(3)	1038.24		1039.07		1038.46	
MW-21	Spoils	1079.3	0.0273	1080.26	0.0224	1078.56	0.0297	1079.52	0.0612
MW-21P	Shale	1078.25		1079.4		1077.42		1077.17	
MW-22	Spoils	1077.83	0.1201	1078.74	0.1169	1077.18	0.1049	1077.2	0.1176
MW-22P	Shale	1071.63		1072.6		1071.83		1071.2	

Notes:
(1) Negative value for vertical gradient indicates upward vertical gradient
(2) Positive value for vertical gradient indicates downward vertical gradient
(3) Vertical gradients for well nest MW-19/MW-19P may not be accurate because this well recovers very slowly.

TABLE 4
SUMMARY OF GROUNDWATER MONITORING PROGRAM
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Upgradient Wells		Downgradient\Sidegradient Wells	
Shale	Spoils	Shale	Spoils
MW-1A MW-19 MW-19P MW-14	MW-23**	MW-20 MW-21P MW-22P	MW-4A* MW-13 MW-21 MW-22

* - Spoils and Foundry Sand
** - Sidegradient well

AJS - c:\projects\asf\monprog.wk3; date 26-Oct-94

Table 5
SUMMARY OF STATISTICAL EXCEEDANCES OF TOLERANCE INTERVALS - SHALE WELLS
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

WELL ID.	DATE	PARAMETER	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	FORMATION WELL IS SCREENED IN
MW21P	17-Dec-93	FLUORIDE	3.3	mg/L	2.04	Shale
MW21P	16-Mar-94	FLUORIDE	3.6	mg/L	2.04	Shale
MW21P	16-Jun-94	FLUORIDE	3.1	mg/L	2.04	Shale
MW21P	14-Sep-94	FLUORIDE	2.9	MG/L	2.04	Shale
MW22P	16-Dec-93	FLUORIDE	9	mg/L	2.04	Shale
MW22P	15-Mar-94	FLUORIDE	10	mg/L	2.04	Shale
MW22P	16-Jun-94	FLUORIDE	9.5	mg/L	2.04	Shale
MW22P	14-Sep-94	FLUORIDE	9.5	MG/L	2.04	Shale
MW20	16-Dec-93	MANGANESE, DISSOLVED	10000	ug/L	2748	Shale
MW20	16-Mar-94	MANGANESE, DISSOLVED	8200	ug/L	2748	Shale
MW20	14-Sep-94	MANGANESE, DISSOLVED	8300	UG/L	2748	Shale
MW21P	17-Dec-93	SODIUM, DISSOLVED	290000	ug/L	212143	Shale
MW21P	16-Jun-94	SODIUM, DISSOLVED	330000	ug/L	212143	Shale
MW21P	14-Sep-94	SODIUM, DISSOLVED	340000	UG/L	212143	Shale
MW22P	16-Dec-93	SODIUM, DISSOLVED	470000	ug/L	212143	Shale
MW22P	15-Mar-94	SODIUM, DISSOLVED	470000	ug/L	212143	Shale
MW22P	16-Jun-94	SODIUM, DISSOLVED	580000	ug/L	212143	Shale
MW22P	14-Sep-94	SODIUM, DISSOLVED	500000	UG/L	212143	Shale
MW21P	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC	43	MG/L	35.5	Shale
MW21P	14-Sep-94	TOTAL ORGANIC HALIDE	59	ug/L	52	Shale

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Table 6

SUMMARY OF STATISTICAL EXCEEDANCES OF TOLERANCE INTERVALS - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

DOWNGRADIEN WELL ID.	DATE	PARAMETER	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	FORMATION WELL IS SCREENED IN
MW04A	15-Mar-94	ALKALINITY, BICARBONATE	480	mg/L	423	Spoils
MW04A	16-Jun-94	ALKALINITY, BICARBONATE	450	mg/L	423	Spoils
MW04A	14-Sep-94	ALKALINITY, CARBONATE	420	MG/L	55	Spoils
MW21	14-Sep-94	ALKALINITY, CARBONATE	350	MG/L	55	Spoils
MW22	14-Sep-94	ALKALINITY, CARBONATE	140	MG/L	55	Spoils
MW13	15-Mar-94	FLUORIDE	0.38	mg/L	0.37	Spoils
MW13	15-Jun-94	FLUORIDE	0.84	mg/L	0.37	Spoils
MW13	14-Sep-94	FLUORIDE	0.88	MG/L	0.37	Spoils
MW21	16-Dec-93	FLUORIDE	0.49	mg/L	0.37	Spoils
MW21	15-Mar-94	FLUORIDE	0.55	mg/L	0.37	Spoils
MW21	17-Jun-94	FLUORIDE	0.85	mg/L	0.37	Spoils
MW21	14-Sep-94	FLUORIDE	0.66	MG/L	0.37	Spoils
MW22	15-Dec-93	FLUORIDE	0.45	mg/L	0.37	Spoils
MW22	15-Mar-94	FLUORIDE	0.66	mg/L	0.37	Spoils
MW22	15-Jun-94	FLUORIDE	0.5	mg/L	0.37	Spoils
MW22	14-Sep-94	FLUORIDE	0.6	MG/L	0.37	Spoils
MW04A	16-Dec-93	MANGANESE, DISSOLVED	7800	ug/L	7221	Spoils
MW13	15-Dec-93	MANGANESE, DISSOLVED	13000	ug/L	7221	Spoils
MW13	15-Mar-94	MANGANESE, DISSOLVED	11000	ug/L	7221	Spoils
MW13	15-Jun-94	MANGANESE, DISSOLVED	15000	ug/L	7221	Spoils
MW13	14-Sep-94	MANGANESE, DISSOLVED	12000	UG/L	7221	Spoils
MW21	16-Dec-93	MANGANESE, DISSOLVED	13000	ug/L	7221	Spoils
MW21	15-Mar-94	MANGANESE, DISSOLVED	11000	ug/L	7221	Spoils
MW21	17-Jun-94	MANGANESE, DISSOLVED	14000	ug/L	7221	Spoils
MW21	14-Sep-94	MANGANESE, DISSOLVED	10000	UG/L	7221	Spoils
MW22	15-Dec-93	MANGANESE, DISSOLVED	8000	ug/L	7221	Spoils
MW21	16-Dec-93	SODIUM, DISSOLVED	130000	ug/L	84733	Spoils
MW21	15-Mar-94	SODIUM, DISSOLVED	130000	ug/L	84733	Spoils
MW21	17-Jun-94	SODIUM, DISSOLVED	130000	ug/L	84733	Spoils
MW21	14-Sep-94	SODIUM, DISSOLVED	120000	UG/L	84733	Spoils
MW04A	16-Dec-93	TOTAL ORGANIC CARBON AS NPOC	7	mg/L	2.1	Spoils
MW04A	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC	13	mg/L	2.1	Spoils
MW04A	16-Jun-94	TOTAL ORGANIC CARBON AS NPOC	2.4	mg/L	2.1	Spoils
MW04A	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC	18	MG/L	2.1	Spoils
MW13	15-Dec-93	TOTAL ORGANIC CARBON AS NPOC	8.2	mg/L	2.1	Spoils
MW13	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC	4.3	mg/L	2.1	Spoils
MW13	15-Jun-94	TOTAL ORGANIC CARBON AS NPOC	3.3	mg/L	2.1	Spoils
MW13	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC	24	MG/L	2.1	Spoils
MW21	16-Dec-93	TOTAL ORGANIC CARBON AS NPOC	15	mg/L	2.1	Spoils
MW21	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC	5.5	mg/L	2.1	Spoils
MW21	17-Jun-94	TOTAL ORGANIC CARBON AS NPOC	16	mg/L	2.1	Spoils
MW21	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC	7.4	MG/L	2.1	Spoils
MW22	15-Dec-93	TOTAL ORGANIC CARBON AS NPOC	27	mg/L	2.1	Spoils
MW22	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC	3.6	mg/L	2.1	Spoils
MW22	15-Jun-94	TOTAL ORGANIC CARBON AS NPOC	4	mg/L	2.1	Spoils
MW22	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC	23	MG/L	2.1	Spoils
MW13	15-Dec-93	ZINC, DISSOLVED	250	ug/L	122	Spoils
MW13	15-Mar-94	ZINC, DISSOLVED	230	ug/L	122	Spoils
MW13	16-Jun-94	ZINC, DISSOLVED	370	ug/L	122	Spoils
MW13	14-Sep-94	ZINC, DISSOLVED	240	UG/L	122	Spoils

Tolerance interval constructed using data from sidegradient well MW-23

SPOILSUM.wk3; date 27-Oct-94

Table 7

PROPOSED GROUNDWATER MONITORING PROGRAM
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Monitoring Wells

Upgradient	Downgradient
MW-1A MW-14 MW-19 MW-19P(1) MW-23 (sidegradient)	MW-4A MW-13 MW-13P(2) MW-20 MW-21 MW-21P MW-22 MW-22P MW-24(2) MW-25(2) MW-12P(2)

Parameters to be Analyzed

Semiannually	Annually
Specific Conductance(3) pH(3) Temperature (3) Iron Fluoride Barium Manganese Arsenic Cadmium Cobalt Zinc Nickel	Chromium Lead Mercury Selenium Silver

(1) Well MW-19P will be purged several days prior to sampling so that sufficient water is available for sampling.

(2) Proposed Monitoring Well

(3) Specific conductance temperatures and pH will be measured in the field. Water levels will also be measured at each well in the program on a semi-annual basis.

APPENDIX E

STATISTICAL ANALYSIS METHODS AND RESULTS

EPA/530-SW-89-026

PB89-151047

STATISTICAL ANALYSIS OF GROUND-WATER MONITORING DATA AT RCRA FACILITIES

INTERIM FINAL GUIDANCE

OFFICE OF SOLID WASTE
WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

FEBRUARY 1989

For data sets with more than 30 observations, the parametric analysis of variance performed on the rank values is a good approximation to the Kruskal-Wallis test (Quade, 1966). If the user has access to SAS, the PROC RANK procedure is used to obtain the ranks of the data. The analysis of variance procedure detailed in Section 5.2.1 is then performed on the ranks. Contrasts are tested as in the parametric analysis of variance.

INTERPRETATION

The Kruskal-Wallis test statistic is compared to the tabulated critical value from the chi-squared distribution. If the test statistic does not exceed the tabulated value, there is no statistically significant evidence of contamination and the analysis would stop and report this finding. If the test statistic exceeds the tabulated value, there is significant evidence that the hypothesis of no differences in compliance concentrations from the background level is not true. Consequently, if the test statistic exceeds the critical value, one concludes that there is significant evidence of contamination. One then proceeds to investigate where the differences lie, that is, which wells are indicating contamination.

The multiple comparisons procedure described in steps 5 and 6 compares each compliance well to the background well. This determines which compliance wells show statistically significant evidence of contamination at an experimentwise error rate of 5 percent. In many cases, inspection of the mean or median concentrations will be sufficient to indicate where the problem lies.

5.3 TOLERANCE INTERVALS BASED ON THE NORMAL DISTRIBUTION

An alternate approach to analysis of variance to determine whether there is statistically significant evidence of contamination is to use tolerance intervals. A tolerance interval is constructed from the data on (uncontaminated) background wells. The concentrations from compliance wells are then compared with the tolerance interval. With the exception of pH, if the compliance concentrations do not fall in the tolerance interval, this provides statistically significant evidence of contamination.

Tolerance intervals are most appropriate for use at facilities that do not exhibit high degrees of spatial variation between background wells and compliance wells. Facilities that overlie extensive, homogeneous geologic deposits (for example, thick, homogeneous lacustrine clays) that do not naturally display hydrogeochemical variations may be suitable for this statistical method of analysis.

A tolerance interval establishes a concentration range that is constructed to contain a specified proportion (P%) of the population with a specified confidence coefficient, Y. The proportion of the population included, P, is referred to as the coverage. The probability with which the tolerance interval includes the proportion P% of the population is referred to as the tolerance coefficient.

A coverage of 95% is recommended. If this is used, random observations from the same distribution as the background well data would exceed the upper tolerance limit less than 5% of the time. Similarly, a tolerance coefficient of 95% is recommended. This means that one has a confidence level of 95% that the upper 95% tolerance limit will contain at least 95% of the distribution of observations from background well data. These values were chosen to be consistent with the performance standards described in Section 2. The use of these values corresponds to the selection of α of 5% in the multiple well testing situation.

The procedure can be applied with as few as three observations from the background distribution. However, doing so would result in a large upper tolerance limit. A sample size of eight or more results is an adequate tolerance interval. The minimum sampling schedule called for in the regulations would result in at least four observations from each background well. Only if a single background well is sampled at a single point in time is the sample size so small as to make use of the procedure questionable.

Tolerance intervals can be constructed assuming that the data or the transformed data are normally distributed. Tolerance intervals can also be constructed assuming other distributions. It is also possible to construct nonparametric tolerance intervals using only the assumption that the data came from some continuous population. However, the nonparametric tolerance intervals require such a large number of observations to provide a reasonable coverage and tolerance coefficient that they are impractical in this application.

The range of the concentration data in the background well samples should be considered in determining whether the tolerance interval approach should be used, and if so, what distribution is appropriate. The background well concentration data should be inspected for outliers and tests of normality applied before selecting the tolerance interval approach. Tests of normality were presented in Section 4.2. Note that in this case, the test of normality would be applied to the background well data that are used to construct the tolerance interval. These data should all be from the same normal distribution.

In this application, unless pH is being monitored, a one-sided tolerance interval or an upper tolerance limit is desired, since contamination is indicated by large concentrations of the hazardous constituents monitored. Thus, for concentrations, the appropriate tolerance interval is (0, TL), with the comparison of importance being the larger limit, TL.

PURPOSE

The purpose of the tolerance interval approach is to define a concentration range from background well data, within which a large proportion of the monitoring observations should fall with high probability. Once this is done, data from compliance wells can be checked for evidence of contamination by simply determining whether they fall in the tolerance interval. If they do not, this is evidence of contamination.

In this case the data are assumed to be approximately normally distributed. Section 4.2 provided methods to check for normality. If the data are not normal, take the natural logarithm of the data and see if the transformed data are approximately normal. If so, this method can be used on the logarithms of the data. Otherwise, seek the assistance of a professional statistician.

PROCEDURE

Step 1. Calculate the mean, $\bar{X}$, and the standard deviation, S, from the background well data.

Step 2. Construct the one-sided upper tolerance limit as

$$TL = \bar{X} + K\,S,$$

where K is the one-sided normal tolerance factor found in Table 5, Appendix B.

Step 3. Compare each observation from compliance wells to the tolerance limit found in Step 2. If any observation exceeds the tolerance limit, that is statistically significant evidence that the well is contaminated. Note that if the tolerance interval was constructed on the logarithms of the original background observations, the logarithms of the compliance well observations should be compared to the tolerance limit. Alternatively the tolerance limit may be transferred to the original data scale by taking the antilogarithm.

REFERENCE

Lieberman, Gerald J. 1958. "Tables for One-sided Statistical Tolerance Limits." *Industrial Quality Control*. Vol. XIV, No. 10.

EXAMPLE

Table 5-5 contains example data that represent lead concentration levels in parts per million in water samples at a hypothetical facility. The background well data are in columns 1 and 2, while the other four columns represent compliance well data.

Step 1. The mean and standard deviation of the n = 8 observations have been calculated for the background well. The mean is 51.4 and the standard deviation is 16.3.

Step 2. The tolerance factor for a one-sided normal tolerance interval is found from Table 5, Appendix B as 3.188. This is for 95% coverage with probability 95% and for n = 8. The upper tolerance limit is then calculated as 51.4 + (3.188)(16.3) = 103.4.

Step 3. The tolerance limit of 103.3 is compared with the compliance well data. Any value that exceeds the tolerance limit indicates statistically significant evidence of contamination. Two observations from Well 1, two observations from Well 3, and all four observations from Well 4 exceed the tolerance limit. Thus there is statistically significant evidence of contamination at Wells 1, 3, and 4.

TABLE 5-5. EXAMPLE DATA FOR NORMAL TOLERANCE INTERVAL

Lead concentrations (ppm)

	Background well		Compliance wells			
Date	A	B	Well 1	Well 2	Well 3	Well 4
Jan 1	58.0	46.1	273.1*	34.1	49.9	225.9*
Feb 1	54.1	76.7	170.7*	93.7	73.0	183.1*
Mar 1	30.0	32.1	32.1	70.8	244.7*	198.3*
Apr 1	46.1	68.0	53.0	83.1	202.4*	160.8*

n = 8
Mean = 51.4
SD = 16.3

The upper 95% coverage tolerance limit with tolerance coefficient of 95% is
51.4 + (3.188)(16.3) = 103.4

* Indicates contamination

INTERPRETATION

A tolerance limit with 95% coverage gives an upper bound below which 95% of the observations of the distribution should fall. The tolerance coefficient used here is 95%, implying that at least 95% of the observations should fall below the tolerance limit with probability 95%, if the compliance well data come from the same distribution as the background data. In other words, in this example, we are 95% certain that 95% of the background lead concentrations are below 104 ppm. If observations exceed the tolerance limit, this is evidence that the compliance well data are not from the same distribution, but rather are from a distribution with higher concentrations. This is interpreted as statistically significant evidence of contamination.

5.4 PREDICTION INTERVALS

A prediction interval is a statistical interval calculated to include one or more future observations from the same population with a specified confidence. This approach is algebraically equivalent to the average replicate (AR) test that is presented in the Technical Enforcement Guidance Document (TEGD), September 1986. In ground-water monitoring, a prediction interval approach may be used to make comparisons between background and compliance well data. This method of analysis is similar to that for calculating a tolerance limit, and familiarity with prediction intervals or personal preference would be the only reason for selecting them over the method for tolerance limits. The concentrations of a hazardous constituent in the background wells are used to establish an interval within which K future observations from the same population are expected to lie with a specified confidence. Then each of K future observations of compliance well concentrations is compared to the prediction interval. The interval is constructed to contain all of K future

It should be noted that the nonparametric methods presented earlier automatically deal with values below detection by regarding them as all tied at a level below any quantitated results. The nonparametric methods may be used if there is a moderate amount of data below detection. If the proportion of nonquantified values in the data exceeds 25%, these methods should be used with caution. They should probably not be used if less than half of the data consists of quantified concentrations.

8.1.1 The DL/2 Method

The amount of data that are below detection plays an important role in selecting the method to deal with the limit of detection problem. If a small proportion of the observations are not detected, these may be replaced with a small number, usually the method detection limit divided by 2 (MDL/2), and the usual analysis performed. This is the recommended method for use with the analysis of various procedure of Section 5:2.1. Seek professional help if in doubt about dealing with values below detection limit. The results of the analysis are generally not sensitive to the specific choice of the replacement number.

As a guideline, if 15% or fewer of the values are not detected, replace them with the method detection limit divided by two and proceed with the appropriate analysis using these modified values. Practical quantitation limits (PQL) for Appendix IX compounds were published by EPA in the Federal Register (Vol 52, No 131, July 9, 1987, pp 25947-25952). These give practical quantitation limits by compound and analytical method that may be used in replacing a small amount of nondetected data with the quantitation limit divided by 2. If approved by the Regional Administrator, site specific PQL's may be used in this procedure. If more than 15% of the values are reported as not detected, it is preferable to use a nonparametric method or a test of proportions.

8.1.2. Test of Proportions

If more than 50% of the data are below detection but at least 10% of the observations are quantified, a test of proportions may be used to compare the background well data with the compliance well data. Clearly, if none of the background well observations were above the detection limit, but all of the compliance well observations were above the detection limit, one would suspect contamination. In general the difference may not be as obvious. However, a higher proportion of quantitated values in compliance wells could provide evidence of contamination. The test of proportions is a method to determine whether a difference in proportion of detected values in the background well observations and compliance well observations provides statistically significant evidence of contamination.

The test of proportions should be used when the proportion of quantified values is small to moderate (i.e., between 10% and 50%). If very few quantified values are found, a method based on the Poisson distribution may be used as an alternative approach. A method based on a tolerance limit for the number of detected compounds and the maximum concentration found for any detected compound has been proposed by Gibbons (1988). This alternative would be appropriate when the number of detected compounds is quite small relative to the number of compounds analyzed for as might occur in detection monitoring.

PURPOSE

The test of proportions determines whether the proportion of compounds detected in the compliance well data differs significantly from the proportion of compounds detected in the background well data. If there is a significant difference, this is statistically significant evidence of contamination.

PROCEDURE

The procedure uses the normal distribution approximation to the binomial distribution. This assumes that the sample size is reasonably large. Generally, if the proportion of detected values is denoted by P, and the sample size is n, then the normal approximation is adequate, provided that nP and n(1-P) both are greater than or equal to 5.

Step 1. Determine X, the number of background well samples in which the compound was detected. Let n be the total number of background well samples analyzed. Compute the proportion of detects:

$$\hat{P}_u = x/n$$

Step 2. Determine Y, the number of compliance well samples in which the compound was detected. Let M be the total number of compliance well samples analyzed. Compute the proportion of detects:

$$\hat{P}_d = y/m$$

Step 3. Compute the standard error of the difference in proportions:

$$S_D = \{[(x+y)/(n+m)][1 - (x+y)/(n+m)][1/n + 1/m]\}^{1/2}$$

and form the statistic:

$$Z = (\hat{P}_u - \hat{P}_d)/S_D$$

Step 4. Compare the absolute value of Z to the 97.5th percentile from the standard normal distribution, 1.96. If the absolute value of Z exceeds 1.96, this provides statistically significant evidence at the 5% significance level that the proportion of compliance well samples where the compound was detected exceeds the proportion of background well samples where the compound was detected. This would be interpreted as evidence of contamination. (The two-sided test is used to provide information about differences in either direction.)

EXAMPLE

Table 8-2 contains data on cadmium concentrations measured in background well and compliance wells at a facility. In the table, "BDL" is used for below detection limit.

TABLE 8-2. EXAMPLE DATA FOR A TEST OF PROPORTIONS

Cadmium concentration (µg/L) at background well (24 samples)		Cadmium concentration (µg/L) at compliance wells (64 samples)		
0.1	BDL	0.12	BDL	0.024
0.12	BDL	0.08	BDL	BDL
BDL*	BDL	BDL	BDL	BDL
0.26	BDL	0.2	0.11	BDL
BDL		BDL	0.06	BDL
0.1		0.1	BDL	BDL
BDL		BDL	0.23	0.1
0.014		0.012	BDL	0.04
BDL		BDL	0.11	BDL
BDL		BDL	BDL	BDL
BDL		BDL	0.031	0.1
BDL		BDL	BDL	BDL
BDL		BDL	BDL	0.01
0.12		0.12	BDL	BDL
BDL		0.07	BDL	BDL
0.21		BDL	BDL	BDL
BDL		0.19	0.12	BDL
0.12		BDL	0.08	BDL
BDL		0.1	BDL	
BDL		BDL	0.26	
		0.01	BDL	
		BDL	0.02	
		BDL	BDL	

*BDL means below detection limit.

Step 1. Estimate the proportion above detection in the background wells. As shown in Table 8-2, there were 24 samples from background wells analyzed for cadmium, so $n = 24$. Of these, 16 were below detection and $x = 8$ were above detection, so $P_u = 8/24 = 0.333$.

Step 2. Estimate the proportion above detection in the compliance wells. There were 64 samples from compliance wells analyzed for cadmium, with 40 below detection and 24 detected values. This gives $m = 64$, $y = 24$, so $P_d = 24/64 = 0.375$.

Step 3. Calculate the standard error of the difference in proportions.

$$S_D = \{[(8+24)/(24+64)][1-(8+24)/(24+64)](1/24 + 1/64)\}^{1/2} = 0.115$$

Step 4. Form the statistic Z and compare it to the normal distribution.

$$Z = \frac{0.375 - 0.333}{0.115} = 0.37$$

which is less in absolute value than the value from the normal distribution, 1.96. Consequently, there is no statistically significant evidence that the proportion of samples with cadmium levels above the detection limit differs in the background well and compliance well samples.

INTERPRETATION

Since the proportion of water samples with detected amounts of cadmium in the compliance wells was not significantly different from that in the background wells, the data are interpreted to provide no evidence of contamination. Had the proportion of samples with detectable levels of cadmium in the compliance wells been significantly higher than that in the background wells this would have been evidence of contamination. Had the proportion been significantly higher in the background wells, additional study would have been required. This could indicate that contamination was migrating from an off-site source, or it could mean that the hydraulic gradient had been incorrectly estimated or had changed and that contamination was occurring from the facility, but the ground-water flow was not in the direction originally estimated. Mounding of contaminants in the ground water near the background wells could also be a possible explanation of this observance.

8.1.3 Cohen's Method

If a confidence interval or a tolerance interval based upon the normal distribution is being constructed, a technique presented by Cohen (1959) specifies a method to adjust the sample mean and sample standard deviation to account for data below the detection limit. The only requirements for the use of this technique is that the data are normally distributed and that the detection limit be always the same. This technique is demonstrated below.

Table E-1

Calculation of Tolerance Intervals

For Upgradient Shale Wells

APPENDIX A
BORING LOGS

LOG OF TEST BORING

F-203 (R 01-87)

PROJECT NAME	ASF Sebring MW Installation
LOCATION	Alliance, Ohio
CONTRACTOR	Summit Drilling
DRILLING METHOD	6 1/4" HSA, Tricone
BORING NO.	MW-19
SHEET NO.	1 OF 1
PROJECT NO.	2169.17
INSTALLATION	
SURFACE ELEV.	
BOREHOLE DIA.	IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
					5	No samples taken See boring log MW-19P for description of lithology
					10	
					15	
					20	
					25	
					30	
					35	
					40	
					45	

GENERAL NOTES

DATE STARTED NOV 23 93

DATE COMPLETED NOV 23 93

RIG CME 75

CREW CHIEF B. Krakow

LOGGED R. Welch CHECKED

WATER LEVEL OBSERVATIONS

WHILE DRILLING ∇

AT COMPLETION ▼

AFTER DRILLING

CAVE-IN: DATE/TIME DEPTH

WATER: DATE/TIME DEPTH

LOG OF TEST BORING

F-203 (R 01-87)

PROJECT NAME	ASF Sebring MW Installation
LOCATION	Alliance, Ohio
CONTRACTOR	Summit Drilling
DRILLING METHOD	HSA, Core, Tricone
BORING NO.	MW-19P
SHEET NO.	1 OF 3
PROJECT NO.	2169.17
INSTALLATION	
SURFACE ELEV.	
BOREHOLE DIA.	4 IN.

SAMPLING NOTES: INTERVAL NO.	TYPE	RECOVERY N	IN	MOISTURE	DEPTH	VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
1	SS	19/25/36				SILTY SAND (SM), fine grained, 20% silt, yellowish brown, 10YR 5/6, very dense, moist, weathered sandstone
2	SS	50/5				
3	SS	50/4			5	S.A.A., but light yellowish brown, 10YR 6/4
						SILT (ML), highly compacted, light yellowish brown, 2.5Y 6/4, moist, very dense, weathered siltstone
4	RC		80		10	SANDSTONE, fine grained, light yellowish brown, 10YR 6/4, rqd=40%, moderately cemented, small amount of brownish yellow, 10YR 6/8, mottling
					15	
5	RC		95		20	SILTSTONE, micaceous, light brownish gray, 10YR 6/2, moderately cemented, distinct, 1.2 mm bedding planes, large concentration of iron staining in vertical and horizontal fractures, rqd=0%, numerous bedding plan fractures
					25	SHALE, very micaceous, dark gray and gray, 2.5Y5N5 and 2.5Y5N5, "zebra" striped, very thin (1-10 mm), undulcting bedding planes, small amount of iron staining along horizontal bedding plan fractures, relatively hard and massive, easily separated along bedding planes, rqd=25% Very soft 6" layer at 28'-28.5'
6	RC		90		30	S.A.A. Rqd=40%
					35	
7	RC		65			

GENERAL NOTES

DATE STARTED	NOV 11 93
DATE COMPLETED	NOV 22 93
RIG	CME 75
CREW CHIEF	E. Pucci
LOGGED	R. Welch
CHECKED	REH

WATER LEVEL OBSERVATIONS

WHILE DRILLING ▽	
AT COMPLETION ▼	
AFTER DRILLING	
CAVE-IN: DATE/TIME	DEPTH
WATER: DATE/TIME	DEPTH

LOG OF TEST BORING

F-203 (R 01-87)

RMT

PROJECT NAME	ASF Sebring MW Installation
LOCATION	Alliance, Ohio
CONTRACTOR	Summit Drilling
DRILLING METHOD	HSA, Core, Tricone
BORING NO.	MW-19P
SHEET NO.	2 OF 3
PROJECT NO.	2169.17
INSTALLATION	
SURFACE ELEV.	
BOREHOLE DIA.	4 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
						Shale, as above, some iron staining in horizontal fractures, extensive in vertical fractures, rqd=10%
					45	
						Void from 47'-52'
8	RC		75		50	
						SHALE, soft, clay like where wet (bottom 1'), very friable when dry (top 1'), 2.5Y5N5/, gray, rqd=0%
					55	
9	RC		85		60	
						SHALE, gray, 2.5Y5N5/, medium hardness, friable, rqd=0%, moderately defined bedding, moist, very fractured horizontal and vertical
					65	SHALE, gray, 2.5Y5N5/, medium hardness, rqd=80%, moderately defined bedding
						S.A.A., but dark green, 2.5Y 4N4/
10	RC		90		70	
					75	
						S.A.A., but softer and dark gray to very dark gray
						Grades into coal
11	RC		90		80	
						COAL, black, 2.5Y 2N2/, rqd=35%
						SHALE, very dary gray, 2.5Y 3N3/, medium hardness, somewhat massive, indistinct bedding, plant material present
					85	

LOG OF TEST BORING

F-203 (R 01-87)

RMT

PROJECT NAME ASF Sebring MW Installation
LOCATION Alliance, Ohio
CONTRACTOR Summit Drilling
DRILLING METHOD HSA, Core, Tricone

BORING NO. MW-19P
SHEET NO. 3 OF 3
PROJECT NO. 2169.17
INSTALLATION
SURFACE ELEV.
BOREHOLE DIA. 4 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
12	RC		95		90	S.A.A., rqd=65%
					95	
13	RC		85		100	S.A.A., rqd=40%
					105	End of boring 105 feet
					110	
					115	
					120	
					125	
					130	

RMT

LOG OF TEST BORING

F-203 (R 01-87)

BORING NO. MW-20
SHEET NO. 1 OF 1
PROJECT NAME ASF Sebring MW Installation
PROJECT NO. 2169.17
LOCATION Alliance, Ohio
INSTALLATION
CONTRACTOR Summit Drilling
SURFACE ELEV.
DRILLING METHOD 4 1/4" ID HSA
BOREHOLE DIA. 10 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
1	SS	7/8/8	12	MW		LEAN CLAY (CL), black, 7.5YR, moist (qu=2.5), very stiff, slightly plastic, spoils
2	SS	10/12/12	12	20		
3	SS	7/9/10	14		5	LEAN CLAY (CL), 50% silt, reddish yellow and gray, 7.5YR 6/6, and 10YR 6/1, dry-moist (qu>4.5), hard, slightly plastic, spoils
4	SS	5/5/10	10			
5	SS	3/6/7	12			
6	SS	4/6/3	10		10	S.A.A., but noncohesive and dry
7	SS	5/3/4	12			SHALE, very friable, light brownish gray, 10YR 6/2, dry, powdered, spoils
8	SS	15/13/14	12			
9	SS	10/15/19	14		15	
10	SS	10/15/19	13			
11	SS	15/13/13	12			
12	SS	12/20/26	13		20	
13	SS	13/16/21	12			
14	SS	12/17/16	10			
15	SS	17/10/10	11			
					25	
					30	SHALE, more competent, light gray, 7.5YR N7/, dry
					∇	S.A.A., wet
					35	S.A.A.
					40	End of boring 39.5 feet

GENERAL NOTES

DATE STARTED NOV 8 93
DATE COMPLETED NOV 8 93
RIG CME 75
CREW CHIEF E. Pucci
LOGGED R. Welch CHECKED REH

WATER LEVEL OBSERVATIONS

WHILE DRILLING ∇ 32.0
AT COMPLETION ▼
AFTER DRILLING
CAVE-IN: DATE/TIME DEPTH
WATER: DATE/TIME DEPTH

RMT

LOG OF TEST BORING

F-203 (R 01-87)

BORING NO.	MW-21
SHEET NO.	1 OF 1
PROJECT NO.	2169.17
INSTALLATION	
SURFACE ELEV.	
BOREHOLE DIA.	IN.

PROJECT NAME ASF Sebring MW Installation

LOCATION Alliance, Ohio

CONTRACTOR Summit Drilling

DRILLING METHOD 4 1/4" ID HSA

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
					5	No samples taken See boring log MW-21P for description of lithology
					10	
					15	
					20	
					25	
					30	
					35	

GENERAL NOTES

DATE STARTED NOV 24 93

DATE COMPLETED NOV 24 93

RIG CME 75

CREW CHIEF E. Pucci

LOGGED R. Welch CHECKED

WATER LEVEL OBSERVATIONS

WHILE DRILLING ▽

AT COMPLETION ▼

AFTER DRILLING

CAVE-IN: DATE/TIME DEPTH

WATER: DATE/TIME DEPTH

LOG OF TEST BORING

RMT

F-203 (R 01-87)

BORING NO. MW-21P
SHEET NO. 1 OF 2
PROJECT NAME ASF Sebring MW Installation
PROJECT NO. 2169.17
LOCATION Alliance, Ohio
INSTALLATION
CONTRACTOR Summit Drilling
SURFACE ELEV.
DRILLING METHOD 4 1/4" ID HSA, Core
BOREHOLE DIA. 10 IN.

SAMPLING NOTES

INTERVAL NO.	INTERVAL TYPE	RECOVERY N	RECOVERY IN
1	SS	4/6/7	4
2	SS	8/6/4	4
3	SS	3/5/3	6
4	SS	3/6/6/7	8
5	SS	7/7/5/6	2
6	SS	3/4/5/8	12
7	SS	7/8/7/10	10
8	SS	3/5/8/7	11
9	SS	7/7/7/8	10
10	SS	7/8/7/12	12
11	SS	6/8/8/8	16
12	SS	4/4/6/7	8
13	SS	10/7/8/7	12
14	SS	6/7/22/11	10
15	SS	4/6/7/8	10
16	SS	3/6/7/7	10
17	SS	6/7/8/3	12

MOISTURE: MW21P; MW21

VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

DEPTH	
0	LEAN CLAY (CL), grayish brown, 10YR 5/2 (qu=3.5), very stiff, plastic, mottling throughout, spoils
5	S.A.A., but dark gray, 10YR 4/1
10	
15	S.A.A., but gray, 5Y 5/1, shale fragments
	LEAN CLAY (CL), as above, brown, 10YR 5/3
20	
25	S.A.A.
30	S.A.A., but wet

GENERAL NOTES

DATE STARTED NOV 23 93
DATE COMPLETED NOV 23 93
RIG CME 75
CREW CHIEF E. Pucci
LOGGED R. Welch CHECKED REH

WATER LEVEL OBSERVATIONS

WHILE DRILLING ☰
AT COMPLETION ☰
AFTER DRILLING
CAVE-IN: DATE/TIME DEPTH
WATER: DATE/TIME DEPTH

RMT

LOG OF TEST BORING

F-203 (R 01-87)

BORING NO. MW-21P

SHEET NO. 2 OF 2

PROJECT NAME ASF Sebring MW Installation

PROJECT NO. 2169.17

LOCATION Alliance, Ohio

INSTALLATION

CONTRACTOR Summit Drilling

SURFACE ELEV.

DRILLING METHOD 4 1/4" ID HSA, Core

BOREHOLE DIA. 10 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
				MW 21P		Sandy seam at 37.5'-39.5'
					40	
						SHALE, gray, 7.5YR N6/, soft weathered, clay like
					45	
18	RC		100			
					50	SHALE, gray, 7.5YR N5/, hard, rqd=40%, distinct, light to dark gray laminous bedding
					55	
19	RC		100			S.A.A.
					60	
					65	End of boring 65 feet
					70	
					75	

RMT

LOG OF TEST BORING

F-203 (R 01-87)

PROJECT NAME ASF Sebring MW Installation
LOCATION Alliance, Ohio
CONTRACTOR Summit Drilling
DRILLING METHOD 4 1/4" ID HSA

BORING NO. MW-22
SHEET NO. 1 OF 1
PROJECT NO. 2169.17
INSTALLATION
SURFACE ELEV.
BOREHOLE DIA. 10 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
						No samples taken See boring log MW-22P for description of lithology
					5	
					10	
					15	
					20	
					25	

GENERAL NOTES

DATE STARTED NOV 11 93
DATE COMPLETED NOV 11 93
RIG CME 75
CREW CHIEF B. Krakow
LOGGED R. Welch CHECKED

WATER LEVEL OBSERVATIONS

WHILE DRILLING ∇
AT COMPLETION ▼
AFTER DRILLING
CAVE-IN: DATE/TIME DEPTH
WATER: DATE/TIME DEPTH

LOG OF TEST BORING

RMT

F-203 (R 01-87)

PROJECT NAME ASF Sebring MW Installation
LOCATION Alliance, Ohio
CONTRACTOR Summit Drilling
DRILLING METHOD 4 1/4" ID HSA, Core

BORING NO. MW-22P
SHEET NO. 1 OF 2
PROJECT NO. 2169.17
INSTALLATION
SURFACE ELEV.
BOREHOLE DIA. 10 IN.

SAMPLING NOTES						
INTERVAL		RECOVERY		MOISTURE		VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
NO.	TYPE	N	IN		DEPTH	
1	SS	6/7/4	12			
2	SS	6/8/6	13			POORLY GRADED SAND (SP), very dark gray, 10YR 3/1, moist, medium dense, foundry sand
3	SS	3/3/5	13		5	
4	SS	3/5/3	14			S.A.A.
5	SS	3/4/6	10			LEAN CLAY (CL), approximately 10% silt, gray, 10YR 5/1, moist (qu=2.0), stiff, slightly plastic, spoils
6	SS	8/3/4	11		10	S.A.A.
7	SS	3/5/5	13			
8	SS	3/10/9	12		▽	SILT (ML), 5-10% medium coarse sand, dark gray, 7.5YR N4/, wet, medium dense, spoils/foundry sand
9	SS	4/8/15	12		15	S.A.A.
10	SS	4/8/7	14			
11	SS	9/10/15	15			S.A.A.
12	SS	7/12/18	12			
13	SS	4/12/13	15		20	LEAN CLAY (CL), 40% silt, slightly plastic, light brownish gray, 10YR 6/2, wet (qu=1), medium stiff to stiff, very angular rock (sandstone/siltstone) fragments' interspersed throughout, very inconsistent color
14	SS	5/10/16	14			
15	SS	10/18/18	15			SHALE, weathered, soft clay like, plastic, light gray, 10YR 6/1
16	SS	12/11/16	16		25	LEAN CLAY (CL), 30-40% silt, slightly plastic, dark grayish brown, 10YR 4/2, wet (qu=5), soft, very inconsistent color, siltstone fragments throughout
17	SS	9	10			
18	SS	11 50/3"	4			
19	SS	50/6" 50/3"	2		30	
						S.A.A.

Handwritten along the moisture column: MW22 MW22 P

GENERAL NOTES	
DATE STARTED	NOV 9 93
DATE COMPLETED	NOV 9 93
RIG	CME 75
CREW CHIEF	E. Pucci
LOGGED	R. Welch
CHECKED	REH

WATER LEVEL OBSERVATIONS	
WHILE DRILLING ▽	12.5
AT COMPLETION ▼	
AFTER DRILLING	
CAVE-IN: DATE/TIME	DEPTH
WATER: DATE/TIME	DEPTH

RMT

LOG OF TEST BORING

F-203 (R 01-87)

PROJECT NAME: ASF Sebring MW Installation
LOCATION: Alliance, Ohio
CONTRACTOR: Summit Drilling
DRILLING METHOD: 4 1/4" ID HSA, Core

BORING NO.: MW-22P
SHEET NO.: 2 OF 2
PROJECT NO.: 2169.17
INSTALLATION:
SURFACE ELEV.:
BOREHOLE DIA.: 10 IN.

SAMPLING NOTES						VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
INTERVAL		RECOVERY		MOISTURE		
NO.	TYPE	N	IN		DEPTH	
				MW22P		S.A.A., but 2" sand layer at top
					40	
						SHALE, soft, weathered, clay like, gray, 7.5YR N6/
					45	
20	RC		60		50	Auger refused at 50' 50' change from HSA to rock coring SHALE, hard, gray, 7.5YR N5/, massive, distinct bedding laminating, rqd=0%
					55	
21	RC		95		60	S.A.A.
						64' vertical fractures
					65	End of boring 65 feet
					70	
					75	

LOG OF TEST BORING

F-203 (R 01-87)

RMT

PROJECT NAME: ASF Sebring MW Installation
LOCATION: Alliance, Ohio
CONTRACTOR: Summit Drilling
DRILLING METHOD: 6 1/4" ID HSA

BORING NO.: MW-23
SHEET NO. 1 OF 1
PROJECT NO.: 2169.17
INSTALLATION:
SURFACE ELEV.:
BOREHOLE DIA.: 12 IN.

SAMPLING NOTES: INTERVAL NO.	TYPE	RECOVERY N	IN	MOISTURE	DEPTH	VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS
1	SS	3/7/9	6	MW 23		LEAN CLAY (CL), reddish yellow, 7.5YR 6/6, dry (qu=4.5+), hard, slightly-moderately plastic, dark brown mottling, spoils
2	SS	6/7/7	7			
3	SS	7/4/9	7			
4	SS	6/6/7	9		5	
5	SS	9/8/8	8			
6	SS	8/9/8	10			
7	SS	6/9/9	12		10	
8	SS	10/8/8	14			
9	SS	9/7/8	14			
10	SS	6/7/9	12		15	
11	SS	7/7/10	16			LEAN CLAY (CL), 10YR 5/4, yellowish brown, moist (qu=4.0-4.5), hard, plastic, some strong brown mottling with shale fragments throughout
12	SS	12/10/9	12			
13	SS	11/11/11	8			
14	SS	13/11/12	10		20	
15	SS	12/4/8	12			
16	SS	7/9/12	12			
17	SS	10/7/7	14		25	
18	SS	7/9/11	12			
19	SS	8/6/10	14			
					30	
					35	
						End of boring 36.5 feet

GENERAL NOTES

DATE STARTED: NOV 22 93
DATE COMPLETED: NOV 23 93
RIG: CME 75
CREW CHIEF: B. Krakow
LOGGED: R. Welch CHECKED: REH

WATER LEVEL OBSERVATIONS

WHILE DRILLING ∇
AT COMPLETION ▼
AFTER DRILLING
CAVE-IN: DATE/TIME DEPTH
WATER: DATE/TIME DEPTH

APPENDIX B
WELL CONSTRUCTION DETAILS

RMT

American Steel Foundries

PROJECT NAME: Sebring Facility NO. 2169.17

WELL NO. MW-19

DATE INSTALLED 11-22-93

ELEV. (T.O.C.)

GROUND SURF. ELEV. 1141.16

1138.7

DEPTH FROM GROUND SURFACE 0 FT.

BENTONITE PELLETS/GRANULAR/POWDER 3/8" Holeplug Benlonite Chips ___ FT.

BACKFILL MATERIAL 3/8" Holeplug Benlonite Chips

BACKFILL METHOD PIPE TREMIE/AUGER TREMIE GRAVITY FILLED

BOREHOLE DIA. 10 IN.

___ FT.

LENGTH OF SOLID PIPE 45 FT.

BENTONITE PELLETS/GRANULAR/POWDER SAA 3/8" Holeplug Benlonite Chips 18 FT.

SILICA SAND Fine Colorado Silica Sand 20 FT.

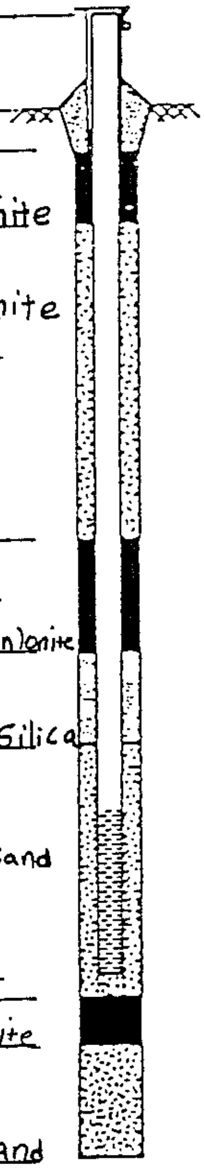
FILTER PACK MATERIAL Coarse Silica Sand 22 FT.

WELL SCREEN LENGTH 10 FT.

WELL BOTTOM ELEV. ________ 32 FT. 32 FT.

SEAL MATERIAL 3/8" Holeplug Benlonite Chips 34 FT.

BACKFILL MATERIAL Coarse Silica Sand 44 FT.



1) CASING DETAILS

A) TYPE OF PIPE: PVC, STAINLESS, TEFLON, OTHER ________

PIPE SCHEDULE 40

B) TYPE OF PIPE JOINTS;

COUPLINGS, THREADED (W/TAPE?), OTHER ________

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC, STAINLESS, TEFLON, OTHER ________

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER ________

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 20 min.

C) APPROXIMATE WATER VOLUME: REMOVED 2 gal.

ADDED ________

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

___ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME Static 27 FT.

DATE/TIME ________ FT.

DATE/TIME ________ FT.

ADDITIONAL COMMENTS: ________

RMT.

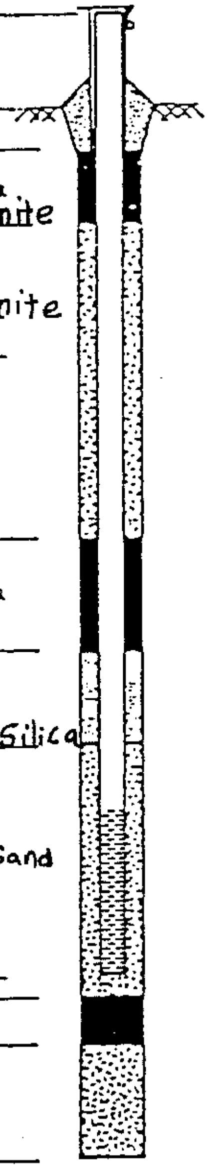
No. [illegible]
F-1, (R 11-85)

American Steel Foundries

PROJECT NAME: Sebring Facility NO. 2169.17

WELL NO. MW-19P

DATE INSTALLED 11-22-93



LENGTH OF SOLID PIPE 01.5 FT.

WELL SCREEN LENGTH 5 FT.

ELEV. (T.O.C.) 1141.16

GROUND SURF. ELEV. 1138.9

DEPTH FROM GROUND SURFACE ___ FT.

BENTONITE PELLETS/GRANULAR/POWDER
3/8" Holeplug Benlonite Pellets — 0 FT.

BACKFILL MATERIAL
3/8" Holeplug Benlonite Chips

BACKFILL METHOD
PIPE TREMIE, AUGER TREMIE, GRAVITY FILLED

BOREHOLE DIA. 6 IN. 0-55' / 4 IN. 65-104

95 FT.

BENTONITE PELLETS/GRANULAR/POWDER — 95 FT.

SILICA SAND
Fine Colorado Silica Sand — 97 FT.

FILTER PACK MATERIAL — 99 FT.
Coarse Silica Sand

WELL BOTTOM ELEV. ___ — 104 FT. / 104 FT.

SEAL MATERIAL NA — ___ FT.

BACKFILL MATERIAL NA — ___ FT.

1) CASING DETAILS

A) TYPE OF PIPE:
PVC, STAINLESS, TEFLON, OTHER ___
PIPE SCHEDULE 80

B) TYPE OF PIPE JOINTS;
COUPLINGS, THREADED (W/TAPE?), OTHER ___

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:
PVC, STAINLESS, TEFLON, OTHER ___

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO
PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD
BAILING, PUMPING, SURGING, COMPRESSED AIR
OTHER ___
(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 30 min.

C) APPROXIMATE WATER VOLUME: REMOVED 12 gal.
ADDED ___

D) WATER CLARITY BEFORE DEVELOPMENT?
CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?
CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?
___ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):
DATE/TIME Static 55.5 FT.
DATE/TIME ___ FT.
DATE/TIME ___ FT.

ADDITIONAL COMMENTS: ___

American Steel Foundries

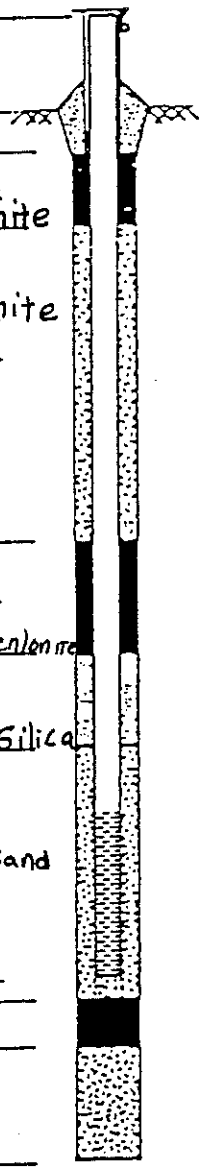
PROJECT NAME: Sebring Facility NO. 2169.17

WELL NO. MW-20

DATE INSTALLED 11-8-93

RMT INC

NO. [illegible]
F-17 (R 11-85)



ELEV. (T.O.C.) 1113.21

GROUND SURF. ELEV. 1110.7

DEPTH FROM GROUND SURFACE 0 FT.

BENTONITE PELLETS/GRANULAR/POWDER, 3/8" Holeplug Bentonite Chips — N/A FT.

BACKFILL MATERIAL 3/8" Holeplug Bentonite Chips

LENGTH OF SOLID PIPE 31.5 FT.

BACKFILL METHOD PIPE TREMIE/AUGER TREMIE GRAVITY FILLED

BOREHOLE DIA. ____ IN.

NA FT.

BENTONITE PELLETS/GRANULAR/POWDER SAA 3/8" Holeplug Bentonite Chips — 24 FT.

SILICA SAND Fine Colorado Silica Sand — 27 FT.

FILTER PACK MATERIAL Coarse Silica Sand — 29 FT.

WELL SCREEN LENGTH 10 FT.

WELL BOTTOM ELEV. ____ 29 FT. 39 FT.

SEAL MATERIAL N/A ____ FT.

BACKFILL MATERIAL NA ____ FT.

1) CASING DETAILS

A) TYPE OF PIPE:

PVC, STAINLESS, TEFLON, OTHER ____

PIPE SCHEDULE 80

B) TYPE OF PIPE JOINTS;

COUPLINGS, THREADED (W/TAPE?), OTHER ____

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC STAINLESS, TEFLON, OTHER ____

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO
PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER ____

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 3 hrs.

C) APPROXIMATE WATER VOLUME: REMOVED 70 gal.
ADDED ____

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

____ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME Static 33.1 FT.

DATE/TIME ____ FT.

DATE/TIME ____ FT.

ADDITIONAL COMMENTS: ____

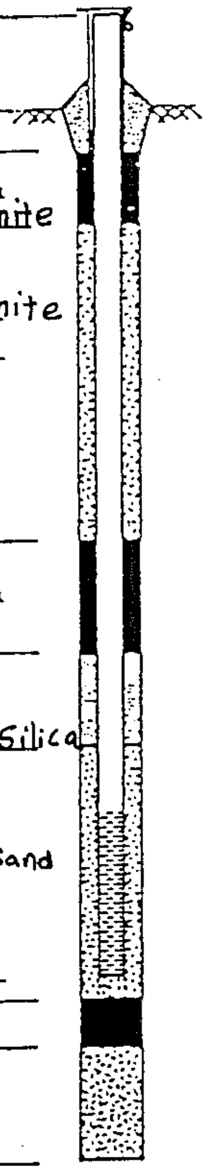
RMT

American Steel Foundries

PROJECT NAME: Sebring Facility NO. 2169.17

WELL NO. MW-21

DATE INSTALLED 11-24-93



ELEV. (T.O.C.) 1101.12

GROUND SURF. ELEV. 1098.6

DEPTH FROM GROUND SURFACE 0 FT.

BENTONITE PELLETS/GRANULAR/POWDER 3/8" Holeplug Bentonite Chips — NA FT.

BACKFILL MATERIAL 3/8" Holeplug Bentonite Chips

BACKFILL METHOD PIPE TREMIE/AUGER TREMIE GRAVITY FILLED

BOREHOLE DIA. 10 IN.

NA FT.

BENTONITE PELLETS/GRANULAR/POWDER SAA — 16 FT.

SILICA SAND Fine Colorado Silica Sand — 18 FT.

FILTER PACK MATERIAL Coarse Silica Sand — 20 FT.

LENGTH OF SOLID PIPE 2.5 FT.

WELL SCREEN LENGTH 10 FT.

WELL BOTTOM ELEV. ______ 30 FT. 31 FT.

SEAL MATERIAL NA — ______ FT.

BACKFILL MATERIAL NA — ______ FT.

1) CASING DETAILS

A) TYPE OF PIPE: PVC, STAINLESS, TEFLON, OTHER ______

PIPE SCHEDULE 40

B) TYPE OF PIPE JOINTS; COUPLINGS, THREADED (W/TAPE?), OTHER ______

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN: PVC STAINLESS, TEFLON, OTHER ______

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER ______

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 45 min.

C) APPROXIMATE WATER VOLUME: REMOVED 30 gal. ADDED ______

D) WATER CLARITY BEFORE DEVELOPMENT? CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT? CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT? ______ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME Static 22.1 FT.

DATE/TIME ______ FT.

DATE/TIME ______ FT.

ADDITIONAL COMMENTS: ______

American Steel Foundries

PROJECT NAME: Sebring Facility NO. 2169.17

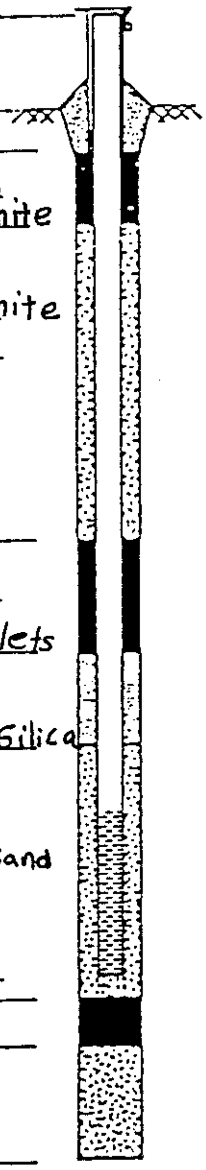
WELL NO. MW-21P

DATE INSTALLED 11-24-93

RMI

ELEV. (T.O.C.) 1100.17

GROUND SURF. ELEV. 1097.7



DEPTH FROM GROUND SURFACE ___ FT.

LENGTH OF SOLID PIPE 25 FT.

BENTONITE PELLETS/GRANULAR/POWDER
3/8" Holeplug Benlonite Chips — 3 FT.

BACKFILL MATERIAL
3/8" Holeplug Benlonite Chips

BOREHOLE DIA. 10 IN.

BACKFILL METHOD
PIPE TREMIE/AUGER TREMIE
GRAVITY FILLED — 53 FT.

BENTONITE
PELLETS/GRANULAR/POWDER
3/8" Benlonite Pellets — 56 FT.

SILICA SAND
Fine Colorado Silica Sand — 60 FT.

FILTER PACK MATERIAL — 60 FT.
Coarse Silica Sand

WELL SCREEN LENGTH 5 FT.

WELL BOTTOM ELEV. — 65 FT. 65 FT.

SEAL MATERIAL
NA — ___ FT.

BACKFILL MATERIAL
NA — ___ FT.

1) CASING DETAILS

A) TYPE OF PIPE:

PVC, STAINLESS, TEFLON, OTHER ___

PIPE SCHEDULE 80

B) TYPE OF PIPE JOINTS:

COUPLINGS, THREADED (W/TAPE?), OTHER ___

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC, STAINLESS, TEFLON, OTHER ___

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO
PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER ___

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 20 min.

C) APPROXIMATE WATER VOLUME: REMOVED 10 gal.

ADDED ___

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

___ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME Static 22.1 FT.

DATE/TIME ___ FT.

DATE/TIME ___ FT.

ADDITIONAL COMMENTS: ___

American Steel Foundries

PROJECT NAME: Sebring Facility NO. 2169.17

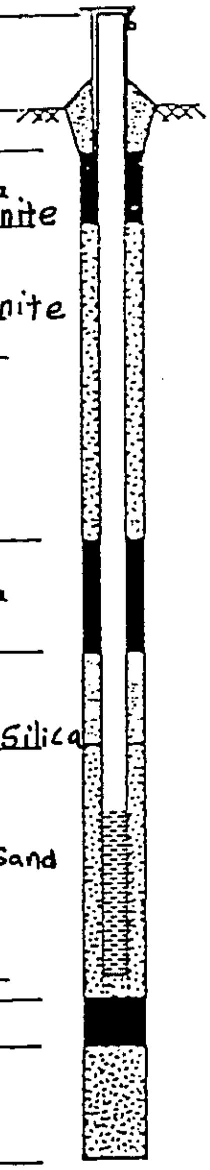
WELL NO. MW-22

DATE INSTALLED 11-11-93

RMI
No. [illegible]
F-1, (R 11-85)

ELEV. (T.O.C.) 1091.01

GROUND SURF. ELEV. 1088.5



DEPTH FROM GROUND SURFACE 0 FT.

BENTONITE PELLETS/GRANULAR/POWDER
3/8" Holeplug Bentonite Chips
NA FT.

BACKFILL MATERIAL
3/8" Holeplug Bentonite Chips

LENGTH OF SOLID PIPE 4.5 FT.

BACKFILL METHOD
PIPE TREMIE/AUGER TREMIE
GRAVITY FILLED

BOREHOLE DIA. 10 IN.

NA FT.

BENTONITE PELLETS/GRANULAR/POWDER
SAA
6 FT.

SILICA SAND
Fine Colorado Silica Sand
8 FT.

FILTER PACK MATERIAL
Coarse Silica Sand
10 FT.

WELL SCREEN LENGTH 10 FT.

WELL BOTTOM ELEV.
20 FT.
20 FT.

SEAL MATERIAL
NA
FT.

BACKFILL MATERIAL
NA
FT.

1) CASING DETAILS

A) TYPE OF PIPE:

PVC, STAINLESS, TEFLON, OTHER

PIPE SCHEDULE 40

B) TYPE OF PIPE JOINTS:

COUPLINGS, THREADED (W/TAPE?), OTHER

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC, STAINLESS, TEFLON, OTHER

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO
PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 35 min.

C) APPROXIMATE WATER VOLUME: REMOVED 5 gal.

ADDED

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME Static 13.4 FT.

DATE/TIME FT.

DATE/TIME FT.

ADDITIONAL COMMENTS:

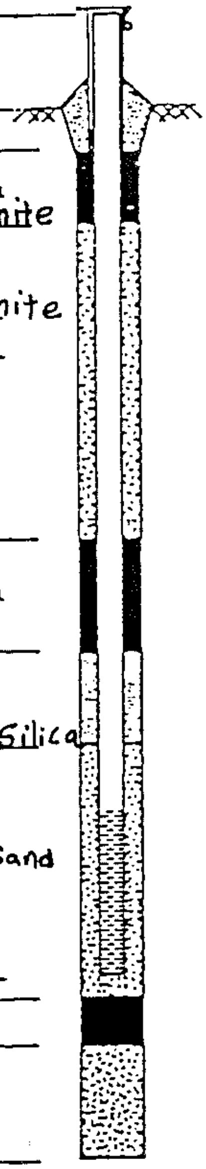
RMT

American Steel Foundries

PROJECT NAME: Sebring Facility NO. 2169.17

WELL NO. MW-22P

DATE INSTALLED 11-10-93



ELEV. (T.O.C.) 1091.23

GROUND SURF. ELEV. 1088.7

DEPTH FROM GROUND SURFACE 17 FT.

BENTONITE PELLETS/GRANULAR/POWDER
3/8" Holeplug Benlonite Chips — 6 FT.

BACKFILL MATERIAL
3/8" Holeplug Benlonite Chips Slurry

LENGTH OF SOLID PIPE 25 FT.

BACKFILL METHOD
PIPE TREMIE, AUGER TREMIE, GRAVITY FILLED

BOREHOLE DIA. 10 IN.

56 FT.

BENTONITE PELLETS/GRANULAR/POWDER
3/8" Pellets — 58 FT.

SILICA SAND
Fine Colorado Silica Sand — 58 FT.

FILTER PACK MATERIAL — 60 FT.
Coarse Silica Sand

WELL SCREEN LENGTH 5 FT.

WELL BOTTOM ELEV. ______ 65 FT. / 63 FT.

SEAL MATERIAL
NA ______ FT.

BACKFILL MATERIAL
NA ______ FT.

1) CASING DETAILS

A) TYPE OF PIPE:
PVC, STAINLESS, TEFLON, OTHER ______
PIPE SCHEDULE 80

B) TYPE OF PIPE JOINTS;
COUPLINGS, THREADED (W/TAPE?), OTHER ______

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:
PVC, STAINLESS, TEFLON, OTHER ______

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO
PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD
BAILING, PUMPING, SURGING, COMPRESSED AIR
OTHER ______
(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 35 min.

C) APPROXIMATE WATER VOLUME: REMOVED 3 gal.
ADDED ______

D) WATER CLARITY BEFORE DEVELOPMENT?
CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?
CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?
______ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):
DATE/TIME Static 15.7 FT.
DATE/TIME ______ FT.
DATE/TIME ______ FT.

ADDITIONAL COMMENTS: ______

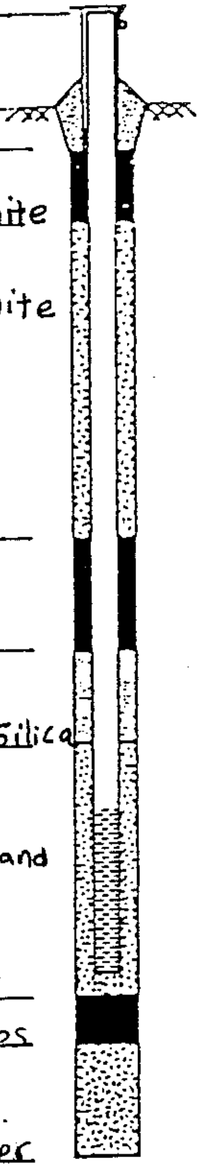
American Steel Foundries

RMI

PROJECT NAME: Sebring Facility NO. 2169.17

WELL NO. MW-23

DATE INSTALLED 11-23-93



ELEV. (T.O.C.) 1107.81

GROUND SURF. ELEV. 1105.3

DEPTH FROM GROUND SURFACE 0 FT.

BENTONITE PELLETS/GRANULAR/POWDER 3/8" Holeplug Benlonite Chips — NA FT.

BACKFILL MATERIAL 3/8" Holeplug Benlonite Chips

8.5 FT. LENGTH OF SOLID PIPE

BOREHOLE DIA. 10 IN.

BACKFILL METHOD PIPE TREMIE/AUGER TREMIE GRAVITY FILLED — NA FT.

BENTONITE PELLETS/GRANULAR/POWDER SAA — 13 FT.

SILICA SAND Fine Colorado Silica Sand — 14 FT.

FILTER PACK MATERIAL Coarse Silicasand — 16 FT.

.0 FT. WELL SCREEN LENGTH

WELL BOTTOM ELEV. ______ — 26 FT. 27 FT.

SEAL MATERIAL 3/8" Holeplug Chips — 30 FT.

BACKFILL MATERIAL 3/8" Holeplug Chips — 35 FT.

1) CASING DETAILS

A) TYPE OF PIPE: PVC, STAINLESS, TEFLON, OTHER ______

PIPE SCHEDULE 40

B) TYPE OF PIPE JOINTS;

COUPLINGS, THREADED (W/TAPE?), OTHER ______

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC, STAINLESS, TEFLON, OTHER ______

E) WELL SCREEN SLOT SIZE 0.010

F) PIPE DIA: ID IN. 2.0 OD IN. 2.3

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER ______

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 35 min.

C) APPROXIMATE WATER VOLUME: REMOVED 18 gal.

ADDED ______

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

______ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME Static 18.5 FT.

DATE/TIME ______ FT.

DATE/TIME ______ FT.

ADDITIONAL COMMENTS: ______

APPENDIX C

TABLES SUMMARIZING MONITORING PROGRAM FROM GROUNDWATER ASSESSMENT PLAN

TABLE 3-1

WATER QUALITY PARAMETERS AND WASTE CONSTITUENT ANALYTICAL METHODS AND PRACTICAL QUANTITATION LIMITS

Parameters	SW-846 Analytical Method	Practical Quantitation Limits
pH	9040/9041	0.1 pH unit
Alkalinity, Carbonate/Bicarbonate	403	20 mg/L
Total Organic Carbon	9060	0.25 mg/L
Total Organic Halogen	9020	0.010 mg/L
Iron - ICP	6010	0.10 mg/L
Chloride	9250	2.0 mg/L
Fluoride	EPA 340.2	0.1 mg/L
Manganese - ICP	6010	0.005 mg/L
Nitrate, Nitrogen	9200	0.05 mg/L
Phenols (colorimetric)	9066	0.01 mg/L
Sodium - ICP	6010	0.50 mg/L
Specific Conductance	9050	10 µmhos/cm
Sulfate	9036	10 mg/L

Notes:

Practical Quantitation Limits are for RMT Laboratories.

ICP - Inductively Coupled Plasma Emission Spectrophotometry.

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result	Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW01A	17-Dec-93	ALKALINITY, BICARBONATE	<	20	mg/L									
MW01A	15-Mar-94	ALKALINITY, BICARBONATE	<	20	mg/L									
MW01A	16-Jun-94	ALKALINITY, BICARBONATE	<	20	mg/L									
MW14	14-Dec-93	ALKALINITY, BICARBONATE		210	mg/L									
MW14	15-Mar-94	ALKALINITY, BICARBONATE		200	mg/L									
MW14	17-Jun-94	ALKALINITY, BICARBONATE		200	mg/L									
MW19	14-Dec-93	ALKALINITY, BICARBONATE	<	20	mg/L									
MW19	16-Mar-94	ALKALINITY, BICARBONATE	<	20	mg/L									
MW19	16-Jun-94	ALKALINITY, BICARBONATE	<	20	mg/L									
MW19P	14-Dec-93	ALKALINITY, BICARBONATE		530	mg/L									
MW19P	15-Mar-94	ALKALINITY, BICARBONATE	<		mg/L									
MW19P	17-Jun-94	ALKALINITY, BICARBONATE	<	20	mg/L									
						11	8	3	73%					
MW01A	17-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L									
MW01A	15-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L									
MW01A	16-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L									
MW01A	14-Sep-94	ALKALINITY, CARBONATE	<	20	MG/L									
MW14	14-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L									
MW14	15-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L									
MW14	17-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L									
MW14	14-Sep-94	ALKALINITY, CARBONATE		200	MG/L									
MW19	14-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L									
MW19	16-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L									
MW19	16-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L									
MW19	14-Sep-94	ALKALINITY, CARBONATE	<	20	MG/L									
MW19P	17-Dec-93	ALKALINITY, CARBONATE		44	mg/L									
MW19P	15-Mar-94	ALKALINITY, CARBONATE	<		mg/L									
MW19P	17-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L									
						14	13	1	93%					
MW01A	17-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L									
MW01A	15-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L									
MW01A	16-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L									
MW01A	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L									
MW14	14-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L									
MW14	15-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L									
MW14	17-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L									
MW14	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L									
MW19	14-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L									
MW19	16-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L									
MW19	16-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L									
MW19	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L									
MW19P	17-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L									
MW19P	15-Mar-94	ANTIMONY, DISSOLVED			ug/L									
MW19P	17-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L									
						14	14	0	100%					
MW01A	17-Dec-93	ARSENIC, DISSOLVED	<	3	ug/L									
MW01A	15-Mar-94	ARSENIC, DISSOLVED	<	3	ug/L									
MW01A	16-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L									
MW01A	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L									
MW14	14-Dec-93	ARSENIC, DISSOLVED	<	3	ug/L									
MW14	15-Mar-94	ARSENIC, DISSOLVED	<	3	ug/L									
MW14	17-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L									
MW14	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L									
MW19	14-Dec-93	ARSENIC, DISSOLVED	<	3	ug/L									
MW19	16-Mar-94	ARSENIC, DISSOLVED	<	3	ug/L									

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result	Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW19	16-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L									
MW19	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L									
MW19P	17-Dec-93	ARSENIC, DISSOLVED		12	ug/L									
MW19P	15-Mar-94	ARSENIC, DISSOLVED			ug/L									
MW19P	17-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L									
						14	13	1	93%					
MW01A	17-Dec-93	BARIUM, DISSOLVED	<	50	ug/L									
MW01A	15-Mar-94	BARIUM, DISSOLVED	<	50	ug/L									
MW01A	16-Jun-94	BARIUM, DISSOLVED	<	50	ug/L									
MW01A	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L									
MW14	14-Dec-93	BARIUM, DISSOLVED	<	50	ug/L									
MW14	15-Mar-94	BARIUM, DISSOLVED	<	50	ug/L									
MW14	17-Jun-94	BARIUM, DISSOLVED	<	50	ug/L									
MW14	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L									
MW19	14-Dec-93	BARIUM, DISSOLVED	<	50	ug/L									
MW19	16-Mar-94	BARIUM, DISSOLVED	<	50	ug/L									
MW19	16-Jun-94	BARIUM, DISSOLVED	<	50	ug/L									
MW19	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L									
MW19P	17-Dec-93	BARIUM, DISSOLVED	<	50	ug/L									
MW19P	15-Mar-94	BARIUM, DISSOLVED			ug/L									
MW19P	17-Jun-94	BARIUM, DISSOLVED	<	50	ug/L									
						14	14	0	100%					
MW01A	17-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L									
MW14	14-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L									
MW19	14-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L									
MW19P	17-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L									
						4	4	0	100%					
MW01A	17-Dec-93	CADMIUM, DISSOLVED		0.76	ug/L									
MW01A	15-Mar-94	CADMIUM, DISSOLVED		3.2	ug/L									
MW01A	16-Jun-94	CADMIUM, DISSOLVED		2	ug/L									
MW01A	14-Sep-94	CADMIUM, DISSOLVED		1.6	UG/L									
MW14	14-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L									
MW14	15-Mar-94	CADMIUM, DISSOLVED	<	0.3	ug/L									
MW14	17-Jun-94	CADMIUM, DISSOLVED	<	0.3	ug/L									
MW14	14-Sep-94	CADMIUM, DISSOLVED	<	0.3	UG/L									
MW19	14-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L									
MW19	16-Mar-94	CADMIUM, DISSOLVED		0.89	ug/L									
MW19	16-Jun-94	CADMIUM, DISSOLVED		0.33	ug/L									
MW19	14-Sep-94	CADMIUM, DISSOLVED		0.66	UG/L									
MW19P	17-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L									
MW19P	15-Mar-94	CADMIUM, DISSOLVED			ug/L									
MW19P	17-Jun-94	CADMIUM, DISSOLVED		0.33	ug/L									
						14	6	8	43%	0.83	0.84	2.614		3.0
MW01A	17-Dec-93	CHLORIDE		97	mg/L									
MW01A	15-Mar-94	CHLORIDE		310	mg/L									
MW01A	16-Jun-94	CHLORIDE		220	mg/L									
MW01A	14-Sep-94	CHLORIDE		270	MG/L									
MW14	14-Dec-93	CHLORIDE		28	mg/L									
MW14	15-Mar-94	CHLORIDE		32	mg/L									
MW14	17-Jun-94	CHLORIDE		23	mg/L									
MW14	14-Sep-94	CHLORIDE		26	MG/L									
MW19	14-Dec-93	CHLORIDE		16	mg/L									
MW19	16-Mar-94	CHLORIDE		13	mg/L									
MW19	16-Jun-94	CHLORIDE		5.1	mg/L									
MW19	14-Sep-94	CHLORIDE		4.8	MG/L									

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result	Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW19P	17-Dec-93	CHLORIDE		210	mg/L									
MW19P	15-Mar-94	CHLORIDE			mg/L									
MW19P	17-Jun-94	CHLORIDE		5.1	mg/L									
						14	0	14	0%	90.00	107.25	2.814		370
MW01A	14-Sep-94	CHLOROFORM	<	10	UG/L									
MW14	14-Sep-94	CHLOROFORM	<	10	UG/L									
MW19	14-Sep-94	CHLOROFORM		0.4	UG/L									
MW01A	17-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L									
MW01A	15-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L									
MW01A	16-Jun-94	CHROMIUM, DISSOLVED		2.9	ug/L									
MW01A	14-Sep-94	CHROMIUM, DISSOLVED		2.5	UG/L									
MW14	14-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L									
MW14	15-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L									
MW14	17-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L									
MW14	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L									
MW19	14-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L									
MW19	16-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L									
MW19	16-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L									
MW19	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L									
MW19P	17-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L									
MW19P	15-Mar-94	CHROMIUM, DISSOLVED			ug/L									
MW19P	17-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L									
						14	12	2	86%					
MW01A	17-Dec-93	COBALT, DISSOLVED	<	50	ug/L									
MW01A	15-Mar-94	COBALT, DISSOLVED	<	50	ug/L									
MW01A	16-Jun-94	COBALT, DISSOLVED		50	ug/L									
MW01A	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L									
MW14	14-Dec-93	COBALT, DISSOLVED	<	50	ug/L									
MW14	15-Mar-94	COBALT, DISSOLVED	<	50	ug/L									
MW14	17-Jun-94	COBALT, DISSOLVED	<	50	ug/L									
MW14	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L									
MW19	14-Dec-93	COBALT, DISSOLVED	<	50	ug/L									
MW19	16-Mar-94	COBALT, DISSOLVED	<	50	ug/L									
MW19	16-Jun-94	COBALT, DISSOLVED	<	50	ug/L									
MW19	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L									
MW19P	17-Dec-93	COBALT, DISSOLVED	<	50	ug/L									
MW19P	15-Mar-94	COBALT, DISSOLVED			ug/L									
MW19P	17-Jun-94	COBALT, DISSOLVED	<	50	ug/L									
MW19P	17-Dec-93	CONDUCTANCE, SPECIFIC		100	UMHOS/CM									
MW19	14-Dec-93	CONDUCTANCE, SPECIFIC		170	UMHOS/CM									
MW19	16-Mar-94	CONDUCTANCE, SPECIFIC		119	UMHOS/CM									
MW01A	17-Dec-93	CONDUCTANCE, SPECIFIC		1100	UMHOS/CM									
MW01A	15-Mar-94	CONDUCTANCE, SPECIFIC		1430	UMHOS/CM									
MW01A	16-Jun-94	CONDUCTANCE, SPECIFIC		1640	UMHOS/CM									
MW14	14-Dec-93	CONDUCTANCE, SPECIFIC		2200	UMHOS/CM									
MW14	15-Mar-94	CONDUCTANCE, SPECIFIC		1920	UMHOS/CM									
MW14	17-Jun-94	CONDUCTANCE, SPECIFIC		2050	UMHOS/CM									
MW19	16-Jun-94	CONDUCTANCE, SPECIFIC		1430	UMHOS/CM									
MW19P	15-Mar-94	CONDUCTANCE, SPECIFIC			UMHOS/CM									
MW19P	17-Jun-94	CONDUCTANCE, SPECIFIC		1430	UMHOS/CM									
MW01A	14-Sep-94	CONDUCTANCE, SPECIFIC		1750	UMHOS/CM									
MW14	14-Sep-94	CONDUCTANCE, SPECIFIC		1950	UMHOS/CM									
MW19	14-Sep-94	CONDUCTANCE, SPECIFIC		1575	UMHOS/CM									
						11	0	11	0%	1679.55	313.23	2.815		2561

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result	Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW01A	17-Dec-93	COPPER, DISSOLVED		16	ug/L									
MW01A	15-Mar-94	COPPER, DISSOLVED		11	ug/L									
MW01A	16-Jun-94	COPPER, DISSOLVED		32	ug/L									
MW01A	14-Sep-94	COPPER, DISSOLVED		34	UG/L									
MW14	14-Dec-93	COPPER, DISSOLVED	<	3	ug/L									
MW14	15-Mar-94	COPPER, DISSOLVED	<	3	ug/L									
MW14	17-Jun-94	COPPER, DISSOLVED	<	3	ug/L									
MW14	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L									
MW19	14-Dec-93	COPPER, DISSOLVED	<	3	ug/L									
MW19	16-Mar-94	COPPER, DISSOLVED	<	3	ug/L									
MW19	16-Jun-94	COPPER, DISSOLVED	<	3	ug/L									
MW19	14-Sep-94	COPPER, DISSOLVED		7.7	UG/L									
MW19P	17-Dec-93	COPPER, DISSOLVED		9.9	ug/L									
MW19P	15-Mar-94	COPPER, DISSOLVED	<		ug/L									
MW19P	17-Jun-94	COPPER, DISSOLVED	<	3	ug/L									
						14	9	5	64%					
MW01A	17-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L									
MW14	14-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L									
MW19	14-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L									
MW19P	17-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L									
MW01A	17-Dec-93	FLUORIDE		0.69	mg/L									
MW01A	15-Mar-94	FLUORIDE		0.82	mg/L									
MW01A	16-Jun-94	FLUORIDE		1.4	mg/L									
MW01A	14-Sep-94	FLUORIDE		0.92	MG/L									
MW14	14-Dec-93	FLUORIDE		0.31	mg/L									
MW14	15-Mar-94	FLUORIDE		0.25	mg/L									
MW14	17-Jun-94	FLUORIDE		0.34	mg/L									
MW14	14-Sep-94	FLUORIDE		0.34	MG/L									
MW19	14-Dec-93	FLUORIDE		0.14	mg/L									
MW19	16-Mar-94	FLUORIDE	<	0.1	mg/L									
MW19	16-Jun-94	FLUORIDE	<	0.1	mg/L									
MW19	14-Sep-94	FLUORIDE	<	0.1	MG/L									
MW19P	17-Dec-93	FLUORIDE		2.1	mg/L									
MW19P	15-Mar-94	FLUORIDE	<		mg/L									
MW19P	17-Jun-94	FLUORIDE	<	0.1	mg/L									
						14	5	9	36%	0.55	0.57	2.614		2.0
MW01A	17-Dec-93	IRON, DISSOLVED		11000	ug/L									
MW01A	15-Mar-94	IRON, DISSOLVED		2000	ug/L									
MW01A	16-Jun-94	IRON, DISSOLVED		21000	ug/L									
MW01A	14-Sep-94	IRON, DISSOLVED		34000	UG/L									
MW14	14-Dec-93	IRON, DISSOLVED		1700	ug/L									
MW14	15-Mar-94	IRON, DISSOLVED		1500	ug/L									
MW14	17-Jun-94	IRON, DISSOLVED		1400	ug/L									
MW14	14-Sep-94	IRON, DISSOLVED		1900	UG/L									
MW19	14-Dec-93	IRON, DISSOLVED	<	100	ug/L									
MW19	16-Mar-94	IRON, DISSOLVED	<	100	ug/L									
MW19	16-Jun-94	IRON, DISSOLVED	<	100	ug/L									
MW19	14-Sep-94	IRON, DISSOLVED	<	100	UG/L									
MW19P	17-Dec-93	IRON, DISSOLVED		330	ug/L									
MW19P	15-Mar-94	IRON, DISSOLVED			ug/L									
MW19P	17-Jun-94	IRON, DISSOLVED	<	100	ug/L									
						14	5	9	36%	5381	9738	2.614		30835
MW01A	17-Dec-93	LEAD, DISSOLVED	<	3	ug/L									
MW01A	15-Mar-94	LEAD, DISSOLVED	<	3	ug/L									

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result	Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW01A	16-Jun-94	LEAD, DISSOLVED	<	3	ug/L									
MW01A	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L									
MW14	14-Dec-93	LEAD, DISSOLVED	<	3	ug/L									
MW14	15-Mar-94	LEAD, DISSOLVED	<	3	ug/L									
MW14	17-Jun-94	LEAD, DISSOLVED	<	3	ug/L									
MW14	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L									
MW19	14-Dec-93	LEAD, DISSOLVED	<	3	ug/L									
MW19	16-Mar-94	LEAD, DISSOLVED	<	3	ug/L									
MW19	16-Jun-94	LEAD, DISSOLVED	<	3	ug/L									
MW19	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L									
MW19P	17-Dec-93	LEAD, DISSOLVED	<	3	ug/L									
MW19P	15-Mar-94	LEAD, DISSOLVED			ug/L									
MW19P	17-Jun-94	LEAD, DISSOLVED	<	3	ug/L									
						14	14	0	100%					
MW01A	17-Dec-93	MANGANESE, DISSOLVED		1200	ug/L									
MW01A	15-Mar-94	MANGANESE, DISSOLVED		1000	ug/L									
MW01A	16-Jun-94	MANGANESE, DISSOLVED		2200	ug/L									
MW01A	14-Sep-94	MANGANESE, DISSOLVED		2700	UG/L									
MW14	14-Dec-93	MANGANESE, DISSOLVED		620	ug/L									
MW14	15-Mar-94	MANGANESE, DISSOLVED		660	ug/L									
MW14	17-Jun-94	MANGANESE, DISSOLVED		670	ug/L									
MW14	14-Sep-94	MANGANESE, DISSOLVED		600	UG/L									
MW19	14-Dec-93	MANGANESE, DISSOLVED		900	ug/L									
MW19	16-Mar-94	MANGANESE, DISSOLVED		59	ug/L									
MW19	16-Jun-94	MANGANESE, DISSOLVED		600	ug/L									
MW19	14-Sep-94	MANGANESE, DISSOLVED		510	UG/L									
MW19P	17-Dec-93	MANGANESE, DISSOLVED	<	5	ug/L									
MW19P	15-Mar-94	MANGANESE, DISSOLVED			ug/L									
MW19P	17-Jun-94	MANGANESE, DISSOLVED		600	ug/L									
						14	1	13	7%	880	714	2.614		2748
MW01A	17-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L									
MW01A	15-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW01A	16-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW01A	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L									
MW14	14-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L									
MW14	15-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW14	17-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW14	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L									
MW19	14-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L									
MW19	16-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW19	16-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW19	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L									
MW19P	17-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L									
MW19P	15-Mar-94	MERCURY, DISSOLVED			ug/L									
MW19P	17-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L									
						14	14	0	100%					
MW01A	17-Dec-93	NICKEL, DISSOLVED	<	40	ug/L									
MW01A	15-Mar-94	NICKEL, DISSOLVED	<	40	ug/L									
MW01A	16-Jun-94	NICKEL, DISSOLVED		71	ug/L									
MW01A	14-Sep-94	NICKEL, DISSOLVED		86	UG/L									
MW14	14-Dec-93	NICKEL, DISSOLVED	<	40	ug/L									
MW14	15-Mar-94	NICKEL, DISSOLVED	<	40	ug/L									
MW14	17-Jun-94	NICKEL, DISSOLVED	<	40	ug/L									
MW14	14-Sep-94	NICKEL, DISSOLVED	<	40	UG/L									
MW19	14-Dec-93	NICKEL, DISSOLVED	<	40	ug/L									

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW19	16-Mar-94	NICKEL, DISSOLVED	<	40 ug/L									
MW19	16-Jun-94	NICKEL, DISSOLVED	<	40 ug/L									
MW19	14-Sep-94	NICKEL, DISSOLVED	<	40 UG/L									
MW19P	17-Dec-93	NICKEL, DISSOLVED	<	40 ug/L									
MW19P	15-Mar-94	NICKEL, DISSOLVED		ug/L									
MW19P	17-Jun-94	NICKEL, DISSOLVED	<	40 ug/L									
					14	12	2	86%					
MW01A	17-Dec-93	NITROGEN, NITRATE		0.52 mg/L									
MW01A	15-Mar-94	NITROGEN, NITRATE	<	0.48 mg/L									
MW01A	16-Jun-94	NITROGEN, NITRATE	<	0.05 mg/L									
MW01A	14-Sep-94	NITROGEN, NITRATE	<	0.25 MG/L									
MW14	14-Dec-93	NITROGEN, NITRATE	<	0.05 mg/L									
MW14	15-Mar-94	NITROGEN, NITRATE	<	0.05 mg/L									
MW14	17-Jun-94	NITROGEN, NITRATE	<	0.05 mg/L									
MW14	14-Sep-94	NITROGEN, NITRATE		0.052 MG/L									
MW19	14-Dec-93	NITROGEN, NITRATE		1.4 mg/L									
MW19	16-Mar-94	NITROGEN, NITRATE		1.1 mg/L									
MW19	16-Jun-94	NITROGEN, NITRATE		1.6 mg/L									
MW19	14-Sep-94	NITROGEN, NITRATE		1.2 MG/L									
MW19P	17-Dec-93	NITROGEN, NITRATE		0.23 mg/L									
MW19P	15-Mar-94	NITROGEN, NITRATE		mg/L									
MW19P	17-Jun-94	NITROGEN, NITRATE		1.6 mg/L									
					14	6	8	43%	0.62	0.60	2.614		2.2
MW14	14-Dec-93	PHENOLICS, TOTAL RECOVERABLE	<	301 mg/L									
MW01A	17-Dec-93	PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L									
MW01A	15-Mar-94	PHENOLICS, TOTAL RECOVERABLE		0.034 mg/L									
MW01A	16-Jun-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L									
MW01A	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01 MG/L									
MW14	15-Mar-94	PHENOLICS, TOTAL RECOVERABLE		0.26 mg/L									
MW14	17-Jun-94	PHENOLICS, TOTAL RECOVERABLE		0.012 mg/L									
MW14	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE		0.02 MG/L									
MW19	14-Dec-93	PHENOLICS, TOTAL RECOVERABLE		0.01 mg/L									
MW19	16-Mar-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L									
MW19	16-Jun-94	PHENOLICS, TOTAL RECOVERABLE		0.01 mg/L									
MW19	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE		0.011 MG/L									
MW19P	17-Dec-93	PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L									
MW19P	15-Mar-94	PHENOLICS, TOTAL RECOVERABLE		mg/L									
MW19P	17-Jun-94	PHENOLICS, TOTAL RECOVERABLE		0.01 mg/L									
					13	5	8	38%	0.03	0.07	2.67		0.2
MW01A	17-Dec-93	SELENIUM, DISSOLVED	<	3 ug/L									
MW01A	15-Mar-94	SELENIUM, DISSOLVED	<	12 ug/L									
MW01A	16-Jun-94	SELENIUM, DISSOLVED	<	3 ug/L									
MW01A	14-Sep-94	SELENIUM, DISSOLVED	<	6 UG/L									
MW14	14-Dec-93	SELENIUM, DISSOLVED	<	3 ug/L									
MW14	15-Mar-94	SELENIUM, DISSOLVED	<	12 ug/L									
MW14	17-Jun-94	SELENIUM, DISSOLVED	<	3 ug/L									
MW14	14-Sep-94	SELENIUM, DISSOLVED	<	6 UG/L									
MW19	14-Dec-93	SELENIUM, DISSOLVED	<	3 ug/L									
MW19	16-Mar-94	SELENIUM, DISSOLVED	<	12 ug/L									
MW19	16-Jun-94	SELENIUM, DISSOLVED	<	3 ug/L									
MW19	14-Sep-94	SELENIUM, DISSOLVED	<	6 UG/L									
MW19P	17-Dec-93	SELENIUM, DISSOLVED	<	3 ug/L									
MW19P	15-Mar-94	SELENIUM, DISSOLVED		ug/L									
MW19P	17-Jun-94	SELENIUM, DISSOLVED	<	3 ug/L									
					14	14	0	100%					0.00

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Well No.	Date	Parameter	Prefix	Result	Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW01A	17-Dec-93	SILVER, DISSOLVED	<	1	ug/L									
MW01A	15-Mar-94	SILVER, DISSOLVED	<	1	ug/L									
MW01A	16-Jun-94	SILVER, DISSOLVED	<	1	ug/L									
MW01A	15-Sep-94	SILVER, DISSOLVED	<	1	UG/L									
MW14	14-Dec-93	SILVER, DISSOLVED	<	1	ug/L									
MW14	15-Mar-94	SILVER, DISSOLVED	<	1	ug/L									
MW14	17-Jun-94	SILVER, DISSOLVED	<	1	ug/L									
MW14	14-Sep-94	SILVER, DISSOLVED	<	1	UG/L									
MW19	14-Dec-93	SILVER, DISSOLVED	<	1	ug/L									
MW19	16-Mar-94	SILVER, DISSOLVED	<	1	ug/L									
MW19	16-Jun-94	SILVER, DISSOLVED	<	1	ug/L									
MW19	14-Sep-94	SILVER, DISSOLVED	<	1	UG/L									
MW19P	17-Dec-93	SILVER, DISSOLVED	<	1	ug/L									
MW19P	15-Mar-94	SILVER, DISSOLVED			ug/L									
MW19P	17-Jun-94	SILVER, DISSOLVED	<	1	ug/L									
						14	14	0	100%					
MW01A	17-Dec-93	SODIUM, DISSOLVED		61000	ug/L									
MW01A	15-Mar-94	SODIUM, DISSOLVED		140000	ug/L									
MW01A	16-Jun-94	SODIUM, DISSOLVED		110000	ug/L									
MW01A	14-Sep-94	SODIUM, DISSOLVED		120000	UG/L									
MW14	14-Dec-93	SODIUM, DISSOLVED		39000	ug/L									
MW14	15-Mar-94	SODIUM, DISSOLVED		37000	ug/L									
MW14	17-Jun-94	SODIUM, DISSOLVED		39000	ug/L									
MW14	14-Sep-94	SODIUM, DISSOLVED		38000	UG/L									
MW19	14-Dec-93	SODIUM, DISSOLVED	<	7600	ug/L									
MW19	16-Mar-94	SODIUM, DISSOLVED		4800	ug/L									
MW19	16-Jun-94	SODIUM, DISSOLVED		5400	ug/L									
MW19	14-Sep-94	SODIUM, DISSOLVED		5800	UG/L									
MW19P	17-Dec-93	SODIUM, DISSOLVED		200000	ug/L									
MW19P	15-Mar-94	SODIUM, DISSOLVED			ug/L									
MW19P	17-Jun-94	SODIUM, DISSOLVED		5400	ug/L									
						14	1	13	7%	58071	58941	2.614		212143
MW01A	17-Dec-93	SULFATE		240	mg/L									
MW01A	15-Mar-94	SULFATE		540	mg/L									
MW01A	16-Jun-94	SULFATE		460	mg/L									
MW01A	14-Sep-94	SULFATE		570	MG/L									
MW14	14-Dec-93	SULFATE		1100	mg/L									
MW14	15-Mar-94	SULFATE		1100	mg/L									
MW14	17-Jun-94	SULFATE		1000	mg/L									
MW14	14-Sep-94	SULFATE		1200	MG/L									
MW19	14-Dec-93	SULFATE		43	mg/L									
MW19	16-Mar-94	SULFATE		32	mg/L									
MW19	16-Jun-94	SULFATE		36	mg/L									
MW19	14-Sep-94	SULFATE		42	MG/L									
MW19P	17-Dec-93	SULFATE		330	mg/L									
MW19P	15-Mar-94	SULFATE			mg/L									
MW19P	17-Jun-94	SULFATE		36	mg/L									
						14	0	14	0%	480.64	433.23	2.614		1613
MW01A	14-Sep-94	SULFIDE	<	1	MG/L									
MW14	14-Sep-94	SULFIDE	<	1	MG/L									
MW19	14-Sep-94	SULFIDE		1.3	MG/L									
MW01A	17-Dec-93	SULFIDE, TOTAL	<	1	mg/L									
MW01A	15-Mar-94	SULFIDE, TOTAL	<	1	mg/L									
MW01A	16-Jun-94	SULFIDE, TOTAL	<	1	mg/L									
MW14	14-Dec-93	SULFIDE, TOTAL		1.9	mg/L									

C:ASFUG1_4.wk3; date 26-Oct-94

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW14	15-Mar-94	SULFIDE, TOTAL		1.2 mg/L									
MW14	17-Jun-94	SULFIDE, TOTAL		2.5 mg/L									
MW19	14-Dec-93	SULFIDE, TOTAL		1.6 mg/L									
MW19	16-Mar-94	SULFIDE, TOTAL	<	1 mg/L									
MW19	16-Jun-94	SULFIDE, TOTAL		1.2 mg/L									
MW19P	17-Dec-93	SULFIDE, TOTAL		3.3 mg/L									
MW19P	15-Mar-94	SULFIDE, TOTAL		mg/L									
MW19P	17-Jun-94	SULFIDE, TOTAL		1.2 mg/L									
					14	6	8	43%	1.44	0.66	2.614		3.2
MW01A	17-Dec-93	THALLIUM, DISSOLVED	<	3 mg/L									
MW14	14-Dec-93	THALLIUM, DISSOLVED	<	3 mg/L									
MW19	14-Dec-93	THALLIUM, DISSOLVED	<	3 mg/L									
MW19P	17-Dec-93	THALLIUM, DISSOLVED	<	3 mg/L									
MW01A	17-Dec-93	TIN, DISSOLVED	<	500 ug/L									
MW01A	15-Mar-94	TIN, DISSOLVED	<	500 ug/L									
MW01A	16-Jun-94	TIN, DISSOLVED	<	500 ug/L									
MW01A	14-Sep-94	TIN, DISSOLVED	<	500 UG/L									
MW14	14-Dec-93	TIN, DISSOLVED	<	500 ug/L									
MW14	15-Mar-94	TIN, DISSOLVED	<	500 ug/L									
MW14	17-Jun-94	TIN, DISSOLVED	<	500 ug/L									
MW14	14-Sep-94	TIN, DISSOLVED	<	500 UG/L									
MW19	14-Dec-93	TIN, DISSOLVED	<	500 ug/L									
MW19	16-Mar-94	TIN, DISSOLVED	<	500 ug/L									
MW19	16-Jun-94	TIN, DISSOLVED	<	500 ug/L									
MW19	14-Sep-94	TIN, DISSOLVED	<	500 UG/L									
MW19P	17-Dec-93	TIN, DISSOLVED	<	500 ug/L									
MW19P	15-Mar-94	TIN, DISSOLVED		ug/L									
MW19P	17-Jun-94	TIN, DISSOLVED	<	500 ug/L									
					14	14	0	100%					
MW01A	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC		101 mg/L									
MW01A	17-Dec-93	TOTAL ORGANIC CARBON AS NPOC		0.6 mg/L									
MW01A	16-Jun-94	TOTAL ORGANIC CARBON AS NPOC		1.7 mg/L									
MW01A	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		17 MG/L									
MW14	14-Dec-93	TOTAL ORGANIC CARBON AS NPOC		3.3 mg/L									
MW14	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC		2.2 mg/L									
MW14	17-Jun-94	TOTAL ORGANIC CARBON AS NPOC		1.2 mg/L									
MW14	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		9.3 MG/L									
MW19	14-Dec-93	TOTAL ORGANIC CARBON AS NPOC		1.9 mg/L									
MW19	16-Mar-94	TOTAL ORGANIC CARBON AS NPOC		1.1 mg/L									
MW19	16-Jun-94	TOTAL ORGANIC CARBON AS NPOC		0.34 mg/L									
MW19	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		26 MG/L									
MW19P	17-Dec-93	TOTAL ORGANIC CARBON AS NPOC		34 mg/L									
MW19P	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC		mg/L									
MW19P	17-Jun-94	TOTAL ORGANIC CARBON AS NPOC		0.34 mg/L									
					13	0	13	0%	7.61	10.67	2.614		35
MW19P	17-Dec-93	TOTAL ORGANIC HALIDES		130 ug/L									
MW01A	17-Dec-93	TOTAL ORGANIC HALIDES		8 ug/L									
MW01A	15-Mar-94	TOTAL ORGANIC HALIDES		20 ug/L									
MW01A	16-Jun-94	TOTAL ORGANIC HALIDES		14 ug/L									
MW01A	14-Sep-94	TOTAL ORGANIC HALIDES		17 UG/L									
MW14	14-Dec-93	TOTAL ORGANIC HALIDES		7.4 ug/L									
MW14	15-Mar-94	TOTAL ORGANIC HALIDES		10 ug/L									
MW14	17-Jun-94	TOTAL ORGANIC HALIDES		6.8 ug/L									
MW14	14-Sep-94	TOTAL ORGANIC HALIDES		62 UG/L									

TABLE E1
CALCULATION OF TOLERANCE INTERVALS FOR UPGRADIENT SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence Limit	Upper 95% Confidence Limit
MW19	14-Dec-93	TOTAL ORGANIC HALIDES	<	5 ug/L									
MW19	16-Mar-94	TOTAL ORGANIC HALIDES		5 ug/L									
MW19	16-Jun-94	TOTAL ORGANIC HALIDES		7.6 ug/L									
MW19	14-Sep-94	TOTAL ORGANIC HALIDES	<	5 UG/L									
MW19P	15-Mar-94	TOTAL ORGANIC HALIDES		ug/L									
MW19P	17-Jun-94	TOTAL ORGANIC HALIDES		7.6 ug/L									
					13	2	11	15%	13.49	14.72	2.614		52
MW01A	17-Dec-93	VANADIUM, DISSOLVED	<	50 ug/L									
MW14	14-Dec-93	VANADIUM, DISSOLVED		50 ug/L									
MW19	14-Dec-93	VANADIUM, DISSOLVED	<	50 ug/L									
MW19P	17-Dec-93	VANADIUM, DISSOLVED	<	50 ug/L									
MW01A	17-Dec-93	ZINC, DISSOLVED		70 ug/L									
MW01A	15-Mar-94	ZINC, DISSOLVED		56 ug/L									
MW01A	16-Jun-94	ZINC, DISSOLVED		160 ug/L									
MW01A	14-Sep-94	ZINC, DISSOLVED		150 UG/L									
MW14	14-Dec-93	ZINC, DISSOLVED		20 ug/L									
MW14	15-Mar-94	ZINC, DISSOLVED		20 ug/L									
MW14	17-Jun-94	ZINC, DISSOLVED	<	20 ug/L									
MW14	14-Sep-94	ZINC, DISSOLVED	<	20 UG/L									
MW19	14-Dec-93	ZINC, DISSOLVED	<	20 ug/L									
MW19	16-Mar-94	ZINC, DISSOLVED	<	20 ug/L									
MW19	16-Jun-94	ZINC, DISSOLVED	<	20 ug/L									
MW19	14-Sep-94	ZINC, DISSOLVED		45 UG/L									
MW19P	17-Dec-93	ZINC, DISSOLVED	<	20 ug/L									
MW19P	15-Mar-94	ZINC, DISSOLVED		ug/L									
MW19P	17-Jun-94	ZINC, DISSOLVED	<	20 ug/L									
					14	7	7	50%	47.21	46.72	2.614		169
MW01A	17-Dec-93	pH, FIELD		3.5 SU									
MW01A	15-Mar-94	pH, FIELD		3.2 SU									
MW01A	16-Jun-94	pH, FIELD		4.1 SU									
MW01A	14-Sep-94	pH, FIELD		4.3 SU									
MW14	14-Dec-93	pH, FIELD		7.2 SU									
MW14	15-Mar-94	pH, FIELD		6.2 SU									
MW14	17-Jun-94	pH, FIELD		7.1 SU									
MW14	14-Sep-94	pH, FIELD		6.8 SU									
MW19	14-Dec-93	pH, FIELD		6.2 SU									
MW19	16-Mar-94	pH, FIELD		5.4 SU									
MW19	16-Jun-94	pH, FIELD		6.5 SU									
MW19	14-Sep-94	pH, FIELD		5.5 SU									
MW19P	17-Dec-93	pH, FIELD		9 SU									
MW19P	15-Mar-94	pH, FIELD		SU									
MW19P	17-Jun-94	pH, FIELD		6.5 SU									
MW19P	14-Sep-94	pH, FIELD		SU									
					14	0	14	0%	5.82	1.46	2.614	2.0	9.6

Table E-2

Comparison of Downgradient and

Upgradient Groundwater Quality - Shale Wells

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW20	16-Dec-93	ALKALINITY, BICARBONATE		330	mg/L			
MW20	16-Mar-94	ALKALINITY, BICARBONATE		370	mg/L			
MW20	16-Jun-94	ALKALINITY, BICARBONATE	<	20	mg/L			
MW21P	17-Dec-93	ALKALINITY, BICARBONATE		360	mg/L			
MW21P	16-Mar-94	ALKALINITY, BICARBONATE		350	mg/L			
MW21P	16-Jun-94	ALKALINITY, BICARBONATE		370	mg/L			
MW22P	16-Dec-93	ALKALINITY, BICARBONATE		770	mg/L			
MW22P	15-Mar-94	ALKALINITY, BICARBONATE		770	mg/L			
MW22P	16-Jun-94	ALKALINITY, BICARBONATE		770	mg/L			
Proportions Test			1	9				
No. of Background Detects (x)		3						
No. of Background Samples (n)		11						
Proportion of Detects (Pu)		0.27						
No. of Downgradient Detects (y)		8						
No. of Downgradient Samples (m)		9						
Proportion of Detects (Pd)		0.89						
Standard of Error		0.2236						
Z Statistic (Z)		-2.7556						
Absolute value of Z exceeds 1.96, therefore there is a difference between upgradient and downgradient water quality at the 5% significance level								
MW20	16-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L			
MW20	16-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L			
MW20	16-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L			
MW20	14-Sep-94	ALKALINITY, CARBONATE		290	MG/L			
MW21P	17-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L			
MW21P	16-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L			
MW21P	16-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L			
MW21P	14-Sep-94	ALKALINITY, CARBONATE		380	MG/L			
MW22P	16-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L			
MW22P	15-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L			
MW22P	16-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L			
MW22P	14-Sep-94	ALKALINITY, CARBONATE		770	MG/L			
Proportions Test			9	12				
No. of Background Detects (x)		1						
No. of Background Samples (n)		14						
Proportion of Detects (Pu)		0.07						
No. of Downgradient Detects (y)		3						
No. of Downgradient Samples (m)		12						
Proportion of Detects (Pd)		0.25						
Standard of Error		0.1419						
Z Statistic (Z)		-1.2581	No Difference					
MW20	16-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L			
MW20	16-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW20	16-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW20	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L			
MW21P	17-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L			
MW21P	16-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW21P	16-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW21P	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L			
MW22P	16-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L			
MW22P	15-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW22P	16-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW22P	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L			
Proportions Test			12	12				
No. of Background Detects (x)		0						
No. of Background Samples (n)		14						
Proportion of Detects (Pu)		0.00						
No. of Downgradient Detects (y)		0						
No. of Downgradient Samples (m)		12						
Proportion of Detects (Pd)		0.00						
Standard of Error		0.0000						
Z Statistic (Z)		ERR	No Difference					
MW20	16-Dec-93	ARSENIC, DISSOLVED	<	3	ug/L			
MW20	16-Mar-94	ARSENIC, DISSOLVED		3.3	ug/L			
MW20	16-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW20	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L			
MW21P	17-Dec-93	ARSENIC, DISSOLVED	<	3	ug/L			
MW21P	16-Mar-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW21P	16-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW21P	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L			
MW22P	16-Dec-93	ARSENIC, DISSOLVED	<	3	ug/L			
MW22P	15-Mar-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW22P	16-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW22P	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L			
Proportions Test			11	12				
No. of Background Detects (x)		1						
No. of Background Samples (n)		14						
Proportion of Detects (Pu)		0.07						
No. of Downgradient Detects (y)		1						
No. of Downgradient Samples (m)		12						

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
Proportion of Detects (Pd)			0.08					
Standard of Error			0.1048					
Z Statistic (Z)			-0.1136	No Difference				
MW20	16-Dec-93	BARIUM, DISSOLVED	<	50	ug/L			
MW20	16-Mar-94	BARIUM, DISSOLVED	<	50	ug/L			
MW20	16-Jun-94	BARIUM, DISSOLVED	<	50	ug/L			
MW20	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L			
MW21P	17-Dec-93	BARIUM, DISSOLVED		120	ug/L			
MW21P	16-Mar-94	BARIUM, DISSOLVED		240	ug/L			
MW21P	16-Jun-94	BARIUM, DISSOLVED		140	ug/L			
MW21P	14-Sep-94	BARIUM, DISSOLVED		140	UG/L			
MW22P	16-Dec-93	BARIUM, DISSOLVED		200	ug/L			
MW22P	15-Mar-94	BARIUM, DISSOLVED		170	ug/L			
MW22P	16-Jun-94	BARIUM, DISSOLVED		110	ug/L			
MW22P	14-Sep-94	BARIUM, DISSOLVED		140	UG/L			
Proportions Test			4	12				
No. of Background Detects (x)			0					
No. of Background Samples (n)			14					
Proportion of Detects (Pu)			0.00					
No. of Downgradient Detects (y)			8					
No. of Downgradient Samples (m)			12					
Proportion of Detects (Pd)			0.67					
Standard of Error			0.1816					
Z Statistic (Z)			-3.6717					
Absolute value of Z exceeds 1.96, therefore there is a difference between upgradient and downgradient water quality at the 5% significance level								
MW20	16-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L			
MW21P	17-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L			
MW22P	16-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L			
MW20	16-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L	3.0		
MW20	16-Mar-94	CADMIUM, DISSOLVED	<	0.3	ug/L	3.0		
MW20	16-Jun-94	CADMIUM, DISSOLVED		0.33	ug/L	3.0		
MW20	14-Sep-94	CADMIUM, DISSOLVED		0.98	UG/L	3.0		
MW21P	17-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L	3.0		
MW21P	16-Mar-94	CADMIUM, DISSOLVED		0.65	ug/L	3.0		
MW21P	16-Jun-94	CADMIUM, DISSOLVED	<	0.3	ug/L	3.0		
MW21P	14-Sep-94	CADMIUM, DISSOLVED	<	0.3	UG/L	3.0		
MW22P	16-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L	3.0		
MW22P	15-Mar-94	CADMIUM, DISSOLVED	<	0.3	ug/L	3.0		
MW22P	16-Jun-94	CADMIUM, DISSOLVED	<	0.3	ug/L	3.0		
MW22P	14-Sep-94	CADMIUM, DISSOLVED	<	0.3	UG/L	3.0		
MW20	16-Dec-93	CHLORIDE		22	mg/L	370		
MW20	16-Mar-94	CHLORIDE		27	mg/L	370		
MW20	16-Jun-94	CHLORIDE		5.1	mg/L	370		
MW20	14-Sep-94	CHLORIDE		20	MG/L	370		
MW21P	17-Dec-93	CHLORIDE		39	mg/L	370		
MW21P	16-Mar-94	CHLORIDE		42	mg/L	370		
MW21P	16-Jun-94	CHLORIDE		35	mg/L	370		
MW21P	14-Sep-94	CHLORIDE		160	MG/L	370		
MW22P	16-Dec-93	CHLORIDE		60	mg/L	370		
MW22P	15-Mar-94	CHLORIDE		62	mg/L	370		
MW22P	16-Jun-94	CHLORIDE		57	mg/L	370		
MW22P	14-Sep-94	CHLORIDE		63	MG/L	370		
MW20	14-Sep-94	CHLOROFORM	<	10	UG/L			
MW21P	14-Sep-94	CHLOROFORM	<	10	UG/L			
MW22P	14-Sep-94	CHLOROFORM	<	10	UG/L			
MW20	16-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L			
MW20	16-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW20	16-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW20	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L			
MW21P	17-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L			
MW21P	16-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW21P	16-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW21P	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L			
MW22P	16-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L			
MW22P	15-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW22P	16-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW22P	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L			
Proportions Test			12	12				
No. of Background Detects (x)			2					
No. of Background Samples (n)			14					
Proportion of Detects (Pu)			0.14					
No. of Downgradient Detects (y)			0					
No. of Downgradient Samples (m)			12					
Proportion of Detects (Pd)			0.00					
Standard of Error			0.1048					

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
Z Statistic (Z)		1.3628						
Difference between upgradient and downgradient, but upgradient has more detects.								
MW20	16-Dec-93	COBALT, DISSOLVED	<	50	ug/L			
MW20	16-Mar-94	COBALT, DISSOLVED	<	50	ug/L			
MW20	16-Jun-94	COBALT, DISSOLVED	<	50	ug/L			
MW20	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L			
MW21P	17-Dec-93	COBALT, DISSOLVED	<	50	ug/L			
MW21P	16-Mar-94	COBALT, DISSOLVED	<	50	ug/L			
MW21P	16-Jun-94	COBALT, DISSOLVED	<	50	ug/L			
MW21P	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L			
MW22P	16-Dec-93	COBALT, DISSOLVED	<	50	ug/L			
MW22P	15-Mar-94	COBALT, DISSOLVED	<	50	ug/L			
MW22P	16-Jun-94	COBALT, DISSOLVED	<	50	ug/L			
MW22P	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L			
Proportions Test			12	12				
No. of Background Detects (x)		1						
No. of Background Samples (n)		14						
Proportion of Detects (Pu)		0.07						
No. of Downgradient Detects (y)		0						
No. of Downgradient Samples (m)		12						
Proportion of Detects (Pd)		0.00						
Standard of Error		0.0757						
Z Statistic (Z)		0.9442	No Difference					
MW20	16-Dec-93	CONDUCTANCE, SPECIFIC		2100	UMHOS/CM	2561		
MW20	16-Mar-94	CONDUCTANCE, SPECIFIC		1850	UMHOS/CM	2561		
MW20	16-Jun-94	CONDUCTANCE, SPECIFIC		1430	UMHOS/CM	2561		
MW21P	17-Dec-93	CONDUCTANCE, SPECIFIC		1800	UMHOS/CM	2561		
MW21P	16-Mar-94	CONDUCTANCE, SPECIFIC		1260	UMHOS/CM	2561		
MW21P	16-Jun-94	CONDUCTANCE, SPECIFIC		1820	UMHOS/CM	2561		
MW22P	16-Dec-93	CONDUCTANCE, SPECIFIC		2300	UMHOS/CM	2561		
MW22P	15-Mar-94	CONDUCTANCE, SPECIFIC		2050	UMHOS/CM	2561		
MW22P	16-Jun-94	CONDUCTANCE, SPECIFIC		2370	UMHOS/CM	2561		
MW20	14-Sep-94	CONDUCTANCE, SPECIFIC		1740	UMHOS/CM	2561		
MW21P	14-Sep-94	CONDUCTANCE, SPECIFIC		1140	UMHOS/CM	2561		
MW22P	14-Sep-94	CONDUCTANCE, SPECIFIC		1340	UMHOS/CM	2561		
MW20	16-Dec-93	COPPER, DISSOLVED	<	3	ug/L			
MW20	16-Mar-94	COPPER, DISSOLVED	<	3	ug/L			
MW20	16-Jun-94	COPPER, DISSOLVED	<	3	ug/L			
MW20	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L			
MW21P	17-Dec-93	COPPER, DISSOLVED	<	3	ug/L			
MW21P	16-Mar-94	COPPER, DISSOLVED	<	3	ug/L			
MW21P	16-Jun-94	COPPER, DISSOLVED	<	3	ug/L			
MW21P	14-Sep-94	COPPER, DISSOLVED		5.6	UG/L			
MW22P	16-Dec-93	COPPER, DISSOLVED	<	3	ug/L			
MW22P	15-Mar-94	COPPER, DISSOLVED	<	3	ug/L			
MW22P	16-Jun-94	COPPER, DISSOLVED	<	3	ug/L			
MW22P	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L			
Proportions Test			11	12				
No. of Background Detects (x)		5						
No. of Background Samples (n)		14						
Proportion of Detects (Pu)		0.36						
No. of Downgradient Detects (y)		1						
No. of Downgradient Samples (m)		12						
Proportion of Detects (Pd)		0.08						
Standard of Error		0.1657						
Z Statistic (Z)		1.6520	No Difference					
MW20	16-Dec-93	CYANIDE, TOTAL	<	0.041	mg/L			
MW21P	17-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L			
MW22P	16-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L			
MW20	16-Dec-93	FLUORIDE		0.48	mg/L	2.0		
MW20	16-Mar-94	FLUORIDE		0.4	mg/L	2.0		
MW20	16-Jun-94	FLUORIDE	<	0.1	mg/L	2.0		
MW20	14-Sep-94	FLUORIDE		0.47	MG/L	2.0		
MW21P	17-Dec-93	FLUORIDE		3.3	mg/L	2.0		YES
MW21P	16-Mar-94	FLUORIDE		3.6	mg/L	2.0		YES
MW21P	16-Jun-94	FLUORIDE		3.1	mg/L	2.0		YES
MW21P	14-Sep-94	FLUORIDE		2.9	MG/L	2.0		YES
MW22P	16-Dec-93	FLUORIDE		9	mg/L	2.0		YES
MW22P	15-Mar-94	FLUORIDE		10	mg/L	2.0		YES
MW22P	16-Jun-94	FLUORIDE		9.5	mg/L	2.0		YES
MW22P	14-Sep-94	FLUORIDE		9.5	MG/L	2.0		YES
MW20	16-Dec-93	IRON, DISSOLVED		12000	ug/L	30835		
MW20	16-Mar-94	IRON, DISSOLVED		19000	ug/L	30835		

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW20	16-Jun-94	IRON, DISSOLVED	<	100 ug/L	30835		
MW20	14-Sep-94	IRON, DISSOLVED		19000 UG/L	30835		
MW21P	17-Dec-93	IRON, DISSOLVED	<	100 ug/L	30835		
MW21P	16-Mar-94	IRON, DISSOLVED	<	100 ug/L	30835		
MW21P	16-Jun-94	IRON, DISSOLVED	<	100 ug/L	30835		
MW21P	14-Sep-94	IRON, DISSOLVED		2300 UG/L	30835		
MW22P	16-Dec-93	IRON, DISSOLVED		630 ug/L	30835		
MW22P	15-Mar-94	IRON, DISSOLVED	<	100 ug/L	30835		
MW22P	16-Jun-94	IRON, DISSOLVED	<	100 ug/L	30835		
MW22P	14-Sep-94	IRON, DISSOLVED		190 UG/L	30835		
MW20	16-Dec-93	LEAD, DISSOLVED	<	3 ug/L			
MW20	16-Mar-94	LEAD, DISSOLVED	<	3 ug/L			
MW20	16-Jun-94	LEAD, DISSOLVED	<	3 ug/L			
MW20	14-Sep-94	LEAD, DISSOLVED	<	3 UG/L			
MW21P	17-Dec-93	LEAD, DISSOLVED	<	3 ug/L			
MW21P	16-Mar-94	LEAD, DISSOLVED	<	3 ug/L			
MW21P	16-Jun-94	LEAD, DISSOLVED	<	3 ug/L			
MW21P	14-Sep-94	LEAD, DISSOLVED	<	3 UG/L			
MW22P	16-Dec-93	LEAD, DISSOLVED	<	3 ug/L			
MW22P	15-Mar-94	LEAD, DISSOLVED	<	3 ug/L			
MW22P	16-Jun-94	LEAD, DISSOLVED	<	3 ug/L			
MW22P	14-Sep-94	LEAD, DISSOLVED	<	6 UG/L			
Proportions Test			12	12			
No. of Background Detects (x)			0				
No. of Background Samples (n)			14				
Proportion of Detects (Pu)			0.00				
No. of Downgradient Detects (y)			0				
No. of Downgradient Samples (m)			12				
Proportion of Detects (Pd)			0.00				
Standard of Error			0.0000				
Z Statistic (Z)			ERR No Difference				
MW20	16-Dec-93	MANGANESE, DISSOLVED		10000 ug/L	2748		Yes
MW20	16-Mar-94	MANGANESE, DISSOLVED		8200 ug/L	2748		
MW20	16-Jun-94	MANGANESE, DISSOLVED		600 ug/L	2748		
MW20	14-Sep-94	MANGANESE, DISSOLVED		8300 UG/L	2748		Yes
MW21P	17-Dec-93	MANGANESE, DISSOLVED		37 ug/L	2748		
MW21P	16-Mar-94	MANGANESE, DISSOLVED		21 ug/L	2748		
MW21P	16-Jun-94	MANGANESE, DISSOLVED		36 ug/L	2748		
MW21P	14-Sep-94	MANGANESE, DISSOLVED		69 UG/L	2748		
MW22P	16-Dec-93	MANGANESE, DISSOLVED		49 ug/L	2748		
MW22P	15-Mar-94	MANGANESE, DISSOLVED		19 ug/L	2748		
MW22P	16-Jun-94	MANGANESE, DISSOLVED		9.4 ug/L	2748		
MW22P	14-Sep-94	MANGANESE, DISSOLVED		22 UG/L	2748		
MW20	16-Dec-93	MERCURY, DISSOLVED	<	0.2 ug/L			
MW20	16-Mar-94	MERCURY, DISSOLVED	<	0.2 ug/L			
MW20	16-Jun-94	MERCURY, DISSOLVED	<	0.2 ug/L			
MW20	14-Sep-94	MERCURY, DISSOLVED	<	0.2 UG/L			
MW21P	17-Dec-93	MERCURY, DISSOLVED	<	0.2 ug/L			
MW21P	16-Mar-94	MERCURY, DISSOLVED	<	0.2 ug/L			
MW21P	16-Jun-94	MERCURY, DISSOLVED	<	0.2 ug/L			
MW21P	14-Sep-94	MERCURY, DISSOLVED	<	0.2 UG/L			
MW22P	16-Dec-93	MERCURY, DISSOLVED	<	0.2 ug/L			
MW22P	15-Mar-94	MERCURY, DISSOLVED	<	0.2 ug/L			
MW22P	16-Jun-94	MERCURY, DISSOLVED	<	0.2 ug/L			
MW22P	14-Sep-94	MERCURY, DISSOLVED	<	0.2 UG/L			
Proportions Test			12	12			
No. of Background Detects (x)			0				
No. of Background Samples (n)			14				
Proportion of Detects (Pu)			0.00				
No. of Downgradient Detects (y)			0				
No. of Downgradient Samples (m)			12				
Proportion of Detects (Pd)			0.00				
Standard of Error			0.0000				
Z Statistic (Z)			ERR No Difference				
MW20	16-Dec-93	NICKEL, DISSOLVED	<	40 ug/L			
MW20	16-Mar-94	NICKEL, DISSOLVED	<	40 ug/L			
MW20	16-Jun-94	NICKEL, DISSOLVED	<	40 ug/L			
MW20	14-Sep-94	NICKEL, DISSOLVED	<	40 UG/L			
MW21P	17-Dec-93	NICKEL, DISSOLVED	<	40 ug/L			
MW21P	16-Mar-94	NICKEL, DISSOLVED	<	40 ug/L			
MW21P	16-Jun-94	NICKEL, DISSOLVED	<	40 ug/L			
MW21P	14-Sep-94	NICKEL, DISSOLVED	<	40 UG/L			
MW22P	16-Dec-93	NICKEL, DISSOLVED	<	40 ug/L			
MW22P	15-Mar-94	NICKEL, DISSOLVED	<	40 ug/L			
MW22P	16-Jun-94	NICKEL, DISSOLVED	<	40 ug/L			
MW22P	14-Sep-94	NICKEL, DISSOLVED	<	40 UG/L			
Proportions Test			12	12			
No. of Background Detects (x)			2				

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE PARAMETER	PREFIX	RESULT UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW20	16-Jun-94 SODIUM, DISSOLVED		5400 ug/L	212143		
MW20	14-Sep-94 SODIUM, DISSOLVED		110000 UG/L	212143		
MW21P	17-Dec-93 SODIUM, DISSOLVED		290000 ug/L	212143		YES
MW21P	16-Mar-94 SODIUM, DISSOLVED		27000 ug/L	212143		
MW21P	16-Jun-94 SODIUM, DISSOLVED		330000 ug/L	212143		YES
MW21P	14-Sep-94 SODIUM, DISSOLVED		340000 UG/L	212143		YES
MW22P	16-Dec-93 SODIUM, DISSOLVED		470000 ug/L	212143		YES
MW22P	15-Mar-94 SODIUM, DISSOLVED		470000 ug/L	212143		YES
MW22P	16-Jun-94 SODIUM, DISSOLVED		580000 ug/L	212143		YES
MW22P	14-Sep-94 SODIUM, DISSOLVED		500000 UG/L	212143		YES
MW20	16-Dec-93 SULFATE		870 mg/L	1613		
MW20	16-Mar-94 SULFATE		790 mg/L	1613		
MW20	16-Jun-94 SULFATE		36 mg/L	1613		
MW20	14-Sep-94 SULFATE		750 MG/L	1613		
MW21P	17-Dec-93 SULFATE		460 mg/L	1613		
MW21P	16-Mar-94 SULFATE		470 mg/L	1613		
MW21P	16-Jun-94 SULFATE		330 mg/L	1613		
MW21P	14-Sep-94 SULFATE		470 MG/L	1613		
MW22P	16-Dec-93 SULFATE		330 mg/L	1613		
MW22P	15-Mar-94 SULFATE		340 mg/L	1613		
MW22P	16-Jun-94 SULFATE		320 mg/L	1613		
MW22P	14-Sep-94 SULFATE		300 MG/L	1613		
MW20	14-Sep-94 SULFIDE	<	1 MG/L	3.2		
MW21P	14-Sep-94 SULFIDE		1.3 MG/L	3.2		
MW22P	14-Sep-94 SULFIDE	<	1 MG/L	3.2		
MW20	16-Dec-93 SULFIDE, TOTAL	<	1 mg/L	3.2		
MW20	16-Mar-94 SULFIDE, TOTAL	<	1 mg/L	3.2		
MW20	16-Jun-94 SULFIDE, TOTAL		1.2 mg/L	3.2		
MW21P	17-Dec-93 SULFIDE, TOTAL	<	1 mg/L	3.2		
MW21P	16-Mar-94 SULFIDE, TOTAL	<	1 mg/L	3.2		
MW21P	16-Jun-94 SULFIDE, TOTAL		2 mg/L	3.2		
MW22P	16-Dec-93 SULFIDE, TOTAL		3.2 mg/L	3.2		
MW22P	15-Mar-94 SULFIDE, TOTAL		1 mg/L	3.2		
MW22P	16-Jun-94 SULFIDE, TOTAL		1.9 mg/L	3.2		
MW20	16-Dec-93 THALLIUM, DISSOLVED	<	3 mg/L			
MW21P	17-Dec-93 THALLIUM, DISSOLVED	<	3 mg/L			
MW22P	16-Dec-93 THALLIUM, DISSOLVED	<	3 mg/L			
MW20	16-Dec-93 TIN, DISSOLVED	<	500 ug/L			
MW20	16-Mar-94 TIN, DISSOLVED	<	500 ug/L			
MW20	16-Jun-94 TIN, DISSOLVED	<	500 ug/L			
MW20	14-Sep-94 TIN, DISSOLVED	<	500 UG/L			
MW21P	17-Dec-93 TIN, DISSOLVED	<	500 ug/L			
MW21P	16-Mar-94 TIN, DISSOLVED	<	500 ug/L			
MW21P	16-Jun-94 TIN, DISSOLVED	<	500 ug/L			
MW21P	14-Sep-94 TIN, DISSOLVED	<	500 UG/L			
MW22P	16-Dec-93 TIN, DISSOLVED	<	500 ug/L			
MW22P	15-Mar-94 TIN, DISSOLVED	<	500 ug/L			
MW22P	16-Jun-94 TIN, DISSOLVED	<	500 ug/L			
MW22P	14-Sep-94 TIN, DISSOLVED	<	500 UG/L			
Proportions Test		12	12			
No. of Background Detects (x)	0					
No. of Background Samples (n)	14					
Proportion of Detects (Pu)	0.00					
No. of Downgradient Detects (y)	0					
No. of Downgradient Samples (m)	12					
Proportion of Detects (Pd)	0.00					
Standard of Error	0.0000					
Z Statistic (Z)	ERR No Difference					
MW20	16-Dec-93 TOTAL ORGANIC CARBON AS NPOC		31 mg/L	36		
MW20	16-Mar-94 TOTAL ORGANIC CARBON AS NPOC		4.4 mg/L	36		
MW20	16-Jun-94 TOTAL ORGANIC CARBON AS NPOC		0.34 mg/L	36		
MW20	14-Sep-94 TOTAL ORGANIC CARBON AS NPOC		7.8 MG/L	36		
MW21P	17-Dec-93 TOTAL ORGANIC CARBON AS NPOC		1.8 mg/L	36		
MW21P	16-Mar-94 TOTAL ORGANIC CARBON AS NPOC		2.3 mg/L	36		
MW21P	16-Jun-94 TOTAL ORGANIC CARBON AS NPOC		2.4 mg/L	36		
MW21P	14-Sep-94 TOTAL ORGANIC CARBON AS NPOC		43 MG/L	36		YES
MW22P	16-Dec-93 TOTAL ORGANIC CARBON AS NPOC		2.8 mg/L	36		
MW22P	15-Mar-94 TOTAL ORGANIC CARBON AS NPOC		2.4 mg/L	36		
MW22P	16-Jun-94 TOTAL ORGANIC CARBON AS NPOC		3.1 mg/L	36		
MW22P	14-Sep-94 TOTAL ORGANIC CARBON AS NPOC		26 MG/L	36		
MW20	16-Dec-93 TOTAL ORGANIC HALIDES		5 ug/L	52		
MW20	16-Mar-94 TOTAL ORGANIC HALIDES		30 ug/L	52		
MW20	16-Jun-94 TOTAL ORGANIC HALIDES		7.6 ug/L	52		

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE PARAMETER	PREFIX	RESULT UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
No. of Background Samples (n)		14				
Proportion of Detects (Pu)		0.14				
No. of Downgradient Detects (y)		0				
No. of Downgradient Samples (m)		12				
Proportion of Detects (Pd)		0.00				
Standard of Error		0.1048				
Z Statistic (Z)		1.3628 No Difference				
MW20	16-Dec-93 NITROGEN, NITRATE	<	0.05 mg/L	2.2		
MW20	16-Mar-94 NITROGEN, NITRATE	<	0.05 mg/L	2.2		
MW20	16-Jun-94 NITROGEN, NITRATE		1.6 mg/L	2.2		
MW20	14-Sep-94 NITROGEN, NITRATE	<	0.05 MG/L	2.2		
MW21P	17-Dec-93 NITROGEN, NITRATE	<	0.05 mg/L	2.2		
MW21P	16-Mar-94 NITROGEN, NITRATE	<	0.05 mg/L	2.2		
MW21P	16-Jun-94 NITROGEN, NITRATE		0.2 mg/L	2.2		
MW21P	14-Sep-94 NITROGEN, NITRATE		0.55 MG/L	2.2		
MW22P	16-Dec-93 NITROGEN, NITRATE	<	0.05 mg/L	2.2		
MW22P	15-Mar-94 NITROGEN, NITRATE	<	0.05 mg/L	2.2		
MW22P	16-Jun-94 NITROGEN, NITRATE	<	0.05 mg/L	2.2		
MW22P	14-Sep-94 NITROGEN, NITRATE	<	0.05 MG/L	2.2		
MW20	16-Dec-93 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW20	16-Mar-94 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW20	16-Jun-94 PHENOLICS, TOTAL RECOVERABLE		0.01 mg/L	0.2		
MW20	14-Sep-94 PHENOLICS, TOTAL RECOVERABLE		0.011 MG/L	0.2		
MW21P	17-Dec-93 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW21P	16-Mar-94 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW21P	16-Jun-94 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW21P	14-Sep-94 PHENOLICS, TOTAL RECOVERABLE		0.015 MG/L	0.2		
MW22P	16-Dec-93 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW22P	15-Mar-94 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW22P	16-Jun-94 PHENOLICS, TOTAL RECOVERABLE	<	0.01 mg/L	0.2		
MW22P	14-Sep-94 PHENOLICS, TOTAL RECOVERABLE	<	0.01 MG/L	0.2		
MW20	16-Dec-93 SELENIUM, DISSOLVED	<	3 ug/L			
MW20	16-Mar-94 SELENIUM, DISSOLVED	<	12 ug/L			
MW20	16-Jun-94 SELENIUM, DISSOLVED	<	3 ug/L			
MW20	14-Sep-94 SELENIUM, DISSOLVED	<	6 UG/L			
MW21P	17-Dec-93 SELENIUM, DISSOLVED	<	3 ug/L			
MW21P	16-Mar-94 SELENIUM, DISSOLVED	<	12 ug/L			
MW21P	16-Jun-94 SELENIUM, DISSOLVED	<	3 ug/L			
MW21P	14-Sep-94 SELENIUM, DISSOLVED	<	6 UG/L			
MW22P	16-Dec-93 SELENIUM, DISSOLVED	<	3 ug/L			
MW22P	15-Mar-94 SELENIUM, DISSOLVED	<	12 ug/L			
MW22P	16-Jun-94 SELENIUM, DISSOLVED	<	3 ug/L			
MW22P	14-Sep-94 SELENIUM, DISSOLVED	<	6 UG/L			
Proportions Test		12	12			
No. of Background Detects (x)		0				
No. of Background Samples (n)		14				
Proportion of Detects (Pu)		0.00				
No. of Downgradient Detects (y)		0				
No. of Downgradient Samples (m)		12				
Proportion of Detects (Pd)		0.00				
Standard of Error		0.0000				
Z Statistic (Z)		ERR No Difference				
MW20	16-Dec-93 SILVER, DISSOLVED	<	1 ug/L			
MW20	16-Mar-94 SILVER, DISSOLVED	<	1 ug/L			
MW20	16-Jun-94 SILVER, DISSOLVED	<	1 ug/L			
MW20	14-Sep-94 SILVER, DISSOLVED	<	1 UG/L			
MW21P	17-Dec-93 SILVER, DISSOLVED	<	1 ug/L			
MW21P	16-Mar-94 SILVER, DISSOLVED	<	1 ug/L			
MW21P	16-Jun-94 SILVER, DISSOLVED	<	1 ug/L			
MW21P	14-Sep-94 SILVER, DISSOLVED	<	1 UG/L			
MW22P	16-Dec-93 SILVER, DISSOLVED	<	1 ug/L			
MW22P	15-Mar-94 SILVER, DISSOLVED	<	1 ug/L			
MW22P	16-Jun-94 SILVER, DISSOLVED	<	1 ug/L			
MW22P	14-Sep-94 SILVER, DISSOLVED	<	1 UG/L			
Proportions Test		12	12			
No. of Background Detects (x)		0				
No. of Background Samples (n)		14				
Proportion of Detects (Pu)		0.00				
No. of Downgradient Detects (y)		0				
No. of Downgradient Samples (m)		12				
Proportion of Detects (Pd)		0.00				
Standard of Error		0.0000				
Z Statistic (Z)		ERR				
MW20	16-Dec-93 SODIUM, DISSOLVED		89000 ug/L	212143		
MW20	16-Mar-94 SODIUM, DISSOLVED		89000 ug/L	212143		

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE PARAMETER	PREFIX	RESULT UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW20	16-Jun-94 IRON, DISSOLVED	<	100 ug/L	30836		
MW20	14-Sep-94 IRON, DISSOLVED		19000 UG/L	30836		
MW21P	17-Dec-93 IRON, DISSOLVED	<	100 ug/L	30836		
MW21P	16-Mar-94 IRON, DISSOLVED	<	100 ug/L	30836		
MW21P	16-Jun-94 IRON, DISSOLVED	<	100 ug/L	30836		
MW21P	14-Sep-94 IRON, DISSOLVED		2300 UG/L	30836		
MW22P	16-Dec-93 IRON, DISSOLVED		630 ug/L	30836		
MW22P	15-Mar-94 IRON, DISSOLVED	<	100 ug/L	30836		
MW22P	16-Jun-94 IRON, DISSOLVED	<	100 ug/L	30836		
MW22P	14-Sep-94 IRON, DISSOLVED		190 UG/L	30836		
MW20	16-Dec-93 LEAD, DISSOLVED	<	3 ug/L			
MW20	16-Mar-94 LEAD, DISSOLVED	<	3 ug/L			
MW20	16-Jun-94 LEAD, DISSOLVED	<	3 ug/L			
MW20	14-Sep-94 LEAD, DISSOLVED	<	3 UG/L			
MW21P	17-Dec-93 LEAD, DISSOLVED	<	3 ug/L			
MW21P	16-Mar-94 LEAD, DISSOLVED	<	3 ug/L			
MW21P	16-Jun-94 LEAD, DISSOLVED	<	3 ug/L			
MW21P	14-Sep-94 LEAD, DISSOLVED	<	3 UG/L			
MW22P	16-Dec-93 LEAD, DISSOLVED	<	3 ug/L			
MW22P	15-Mar-94 LEAD, DISSOLVED	<	3 ug/L			
MW22P	16-Jun-94 LEAD, DISSOLVED	<	3 ug/L			
MW22P	14-Sep-94 LEAD, DISSOLVED	<	6 UG/L			
Proportions Test		12	12			
No. of Background Detects (x)		0				
No. of Background Samples (n)		14				
Proportion of Detects (Pu)		0.00				
No. of Downgradient Detects (y)		0				
No. of Downgradient Samples (m)		12				
Proportion of Detects (Pd)		0.00				
Standard of Error		0.0000				
Z Statistic (Z)		ERR No Difference				
MW20	16-Dec-93 MANGANESE, DISSOLVED		10000 ug/L	2748		Yes
MW20	16-Mar-94 MANGANESE, DISSOLVED		8200 ug/L	2748		
MW20	16-Jun-94 MANGANESE, DISSOLVED		600 ug/L	2748		
MW20	14-Sep-94 MANGANESE, DISSOLVED		8300 UG/L	2748		Yes
MW21P	17-Dec-93 MANGANESE, DISSOLVED		37 ug/L	2748		
MW21P	16-Mar-94 MANGANESE, DISSOLVED		21 ug/L	2748		
MW21P	16-Jun-94 MANGANESE, DISSOLVED		36 ug/L	2748		
MW21P	14-Sep-94 MANGANESE, DISSOLVED		69 UG/L	2748		
MW22P	16-Dec-93 MANGANESE, DISSOLVED		49 ug/L	2748		
MW22P	15-Mar-94 MANGANESE, DISSOLVED		19 ug/L	2748		
MW22P	16-Jun-94 MANGANESE, DISSOLVED		9.4 ug/L	2748		
MW22P	14-Sep-94 MANGANESE, DISSOLVED		22 UG/L	2748		
MW20	16-Dec-93 MERCURY, DISSOLVED	<	0.2 ug/L			
MW20	16-Mar-94 MERCURY, DISSOLVED	<	0.2 ug/L			
MW20	16-Jun-94 MERCURY, DISSOLVED	<	0.2 ug/L			
MW20	14-Sep-94 MERCURY, DISSOLVED	<	0.2 UG/L			
MW21P	17-Dec-93 MERCURY, DISSOLVED	<	0.2 ug/L			
MW21P	16-Mar-94 MERCURY, DISSOLVED	<	0.2 ug/L			
MW21P	16-Jun-94 MERCURY, DISSOLVED	<	0.2 ug/L			
MW21P	14-Sep-94 MERCURY, DISSOLVED	<	0.2 UG/L			
MW22P	16-Dec-93 MERCURY, DISSOLVED	<	0.2 ug/L			
MW22P	15-Mar-94 MERCURY, DISSOLVED	<	0.2 ug/L			
MW22P	16-Jun-94 MERCURY, DISSOLVED	<	0.2 ug/L			
MW22P	14-Sep-94 MERCURY, DISSOLVED	<	0.2 UG/L			
Proportions Test		12	12			
No. of Background Detects (x)		0				
No. of Background Samples (n)		14				
Proportion of Detects (Pu)		0.00				
No. of Downgradient Detects (y)		0				
No. of Downgradient Samples (m)		12				
Proportion of Detects (Pd)		0.00				
Standard of Error		0.0000				
Z Statistic (Z)		ERR No Difference				
MW20	16-Dec-93 NICKEL, DISSOLVED	<	40 ug/L			
MW20	16-Mar-94 NICKEL, DISSOLVED	<	40 ug/L			
MW20	16-Jun-94 NICKEL, DISSOLVED	<	40 ug/L			
MW20	14-Sep-94 NICKEL, DISSOLVED	<	40 UG/L			
MW21P	17-Dec-93 NICKEL, DISSOLVED	<	40 ug/L			
MW21P	16-Mar-94 NICKEL, DISSOLVED	<	40 ug/L			
MW21P	16-Jun-94 NICKEL, DISSOLVED	<	40 ug/L			
MW21P	14-Sep-94 NICKEL, DISSOLVED	<	40 UG/L			
W22P	16-Dec-93 NICKEL, DISSOLVED	<	40 ug/L			
N22P	15-Mar-94 NICKEL, DISSOLVED	<	40 ug/L			
MW22P	16-Jun-94 NICKEL, DISSOLVED	<	40 ug/L			
MW22P	14-Sep-94 NICKEL, DISSOLVED	<	40 UG/L			
Proportions Test		12	12			
No. of Background Detects (x)		2				

TABLE E2
COMPARISON OF DOWNGRADIENT AND UPGRADIENT GROUNDWATER QUALITY - SHALE WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW20	14-Sep-94	TOTAL ORGANIC HALIDES		5.8	UG/L	52		
MW21P	17-Dec-93	TOTAL ORGANIC HALIDES		11	ug/L	52		
MW21P	16-Mar-94	TOTAL ORGANIC HALIDES	<	5	ug/L	52		
MW21P	16-Jun-94	TOTAL ORGANIC HALIDES		8.2	ug/L	52		
MW21P	14-Sep-94	TOTAL ORGANIC HALIDES		59	UG/L	52		YES
MW22P	16-Dec-93	TOTAL ORGANIC HALIDES	<	5	ug/L	52		
MW22P	15-Mar-94	TOTAL ORGANIC HALIDES		17	ug/L	52		
MW22P	16-Jun-94	TOTAL ORGANIC HALIDES		7.2	ug/L	52		
MW22P	14-Sep-94	TOTAL ORGANIC HALIDES		7.4	UG/L	52		
MW20	16-Dec-93	VANADIUM, DISSOLVED	<	50	ug/L			
MW21P	17-Dec-93	VANADIUM, DISSOLVED	<	50	ug/L			
MW22P	16-Dec-93	VANADIUM, DISSOLVED	<	50	ug/L			
MW20	16-Dec-93	ZINC, DISSOLVED	<	20	ug/L	169		
MW20	16-Mar-94	ZINC, DISSOLVED	<	20	ug/L	169		
MW20	16-Jun-94	ZINC, DISSOLVED	<	20	ug/L	169		
MW20	14-Sep-94	ZINC, DISSOLVED		21	UG/L	169		
MW21P	17-Dec-93	ZINC, DISSOLVED	<	20	ug/L	169		
MW21P	15-Mar-94	ZINC, DISSOLVED	<	20	ug/L	169		
MW21P	16-Jun-94	ZINC, DISSOLVED	<	20	ug/L	169		
MW21P	14-Sep-94	ZINC, DISSOLVED	<	20	UG/L	169		
MW22P	16-Dec-93	ZINC, DISSOLVED	<	20	ug/L	169		
MW22P	16-Mar-94	ZINC, DISSOLVED	<	20	ug/L	169		
MW22P	16-Jun-94	ZINC, DISSOLVED	<	20	ug/L	169		
MW22P	14-Sep-94	ZINC, DISSOLVED		35	UG/L	169		
MW20	16-Dec-93	pH, FIELD		6.6	SU	9.7	2.0	
MW20	16-Mar-94	pH, FIELD		5.7	SU	9.7	2.0	
MW20	16-Jun-94	pH, FIELD		6.5	SU	9.7	2.0	
MW21P	17-Dec-93	pH, FIELD		7.8	SU	9.7	2.0	
MW21P	16-Mar-94	pH, FIELD		7	SU	9.7	2.0	
MW21P	16-Jun-94	pH, FIELD		7.5	SU	9.7	2.0	
MW22P	16-Dec-93	pH, FIELD		8.2	SU	9.7	2.0	
MW22P	15-Mar-94	pH, FIELD		7.3	SU	9.7	2.0	
MW22P	16-Jun-94	pH, FIELD		8.1	SU	9.7	2.0	
MW20	14-Sep-94	pH, FIELD		6.6	SU	9.7	2.0	
MW21P	14-Sep-94	pH, FIELD		6.4	SU	9.7	2.0	
MW22P	14-Sep-94	pH, FIELD		8.1	SU	9.7	2.0	

Table E-3

Calculation of Tolerance Intervals

For Sidegradient Well MW-23

TABLE E3
CALCULATION OF TOLERANCE INTERVALS FOR SIDEGRADIENT SPOILS WELL MW-23
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence	Upper 95% Confidence
MW23	15-Dec-93	ALKALINITY, BICARBONATE		160 mg/L									
MW23	16-Mar-94	ALKALINITY, BICARBONATE		66 mg/L									
MW23	16-Jun-94	ALKALINITY, BICARBONATE		76 mg/L									
					3	0	3	0%	100.67	42.15	7.655		423
MW23	15-Dec-93	ALKALINITY, CARBONATE	<	20 mg/L									
MW23	16-Mar-94	ALKALINITY, CARBONATE	<	20 mg/L									
MW23	16-Jun-94	ALKALINITY, CARBONATE	<	20 mg/L									
MW23	14-Sep-94	ALKALINITY, CARBONATE		34 MG/L									
					4	3	1	75%	23.50	6.06	5.145		55
MW23	15-Dec-93	ANTIMONY, DISSOLVED	<	10 ug/L									
MW23	16-Mar-94	ANTIMONY, DISSOLVED	<	10 ug/L									
MW23	16-Jun-94	ANTIMONY, DISSOLVED	<	10 ug/L									
MW23	14-Sep-94	ANTIMONY, DISSOLVED	<	10 UG/L									
MW23	15-Dec-93	ARSENIC, DISSOLVED	<	3 ug/L									
MW23	16-Mar-94	ARSENIC, DISSOLVED	<	3 ug/L									
MW23	16-Jun-94	ARSENIC, DISSOLVED	<	3 ug/L									
MW23	14-Sep-94	ARSENIC, DISSOLVED	<	3 UG/L									
MW23	15-Dec-93	BARIUM, DISSOLVED	<	50 ug/L									
MW23	16-Mar-94	BARIUM, DISSOLVED	<	50 ug/L									
MW23	16-Jun-94	BARIUM, DISSOLVED	<	50 ug/L									
MW23	14-Sep-94	BARIUM, DISSOLVED	<	50 UG/L									
MW23	15-Dec-93	BERYLLIUM, DISSOLVED	<	5 ug/L									
MW23	15-Dec-93	CADMIUM, DISSOLVED		0.7 ug/L									
MW23	16-Mar-94	CADMIUM, DISSOLVED		4.6 ug/L									
MW23	16-Jun-94	CADMIUM, DISSOLVED	<	0.3 ug/L									
MW23	14-Sep-94	CADMIUM, DISSOLVED	<	0.3 UG/L									
					4	2	2	50%	1.48	1.81	5.145		10.8
MW23	15-Dec-93	CHLORIDE		26 mg/L									
MW23	16-Mar-94	CHLORIDE		240 mg/L									
MW23	16-Jun-94	CHLORIDE		87 mg/L									
MW23	14-Sep-94	CHLORIDE		240 MG/L									
					4	0	4	0%	148.25	94.25	5.145		633
MW23	14-Sep-94	CHLOROFORM	<	10 UG/L									
MW23	15-Dec-93	CHROMIUM, DISSOLVED	<	2 ug/L									
MW23	16-Mar-94	CHROMIUM, DISSOLVED	<	2 ug/L									
MW23	16-Jun-94	CHROMIUM, DISSOLVED	<	2 ug/L									
MW23	14-Sep-94	CHROMIUM, DISSOLVED	<	2 UG/L									
MW23	15-Dec-93	COBALT, DISSOLVED	<	50 ug/L									
MW23	16-Mar-94	COBALT, DISSOLVED	<	50 ug/L									
MW23	16-Jun-94	COBALT, DISSOLVED	<	50 ug/L									
MW23	14-Sep-94	COBALT, DISSOLVED	<	50 UG/L									
MW23	15-Dec-93	CONDUCTANCE, SPECIFIC		2100 UMHOS/CM									
MW23	16-Mar-94	CONDUCTANCE, SPECIFIC		1300 UMHOS/CM									
MW23	16-Jun-94	CONDUCTANCE, SPECIFIC		1580 UMHOS/CM									
MW23	14-Sep-94	CONDUCTANCE, SPECIFIC		1071 UMHOS/CM									
					4	0	4	0%	1512.75	383.99	5.145		3488
MW23	15-Dec-93	COPPER, DISSOLVED	<	3 ug/L									
MW23	16-Mar-94	COPPER, DISSOLVED	<	3 ug/L									

TABLE E3
CALCULATION OF TOLERANCE INTERVALS FOR SIDEGRADIENT SPOILS WELL MW-23
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result	Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence	Upper 95% Confidence
MW23	16-Jun-94	COPPER, DISSOLVED	<	3	ug/L									
MW23	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L									
MW23	15-Dec-93	CYANIDE, TOTAL		0.01	mg/L									
MW23	15-Dec-93	FLUORIDE		0.22	mg/L									
MW23	16-Mar-94	FLUORIDE		0.12	mg/L									
MW23	16-Jun-94	FLUORIDE		0.15	mg/L									
MW23	14-Sep-94	FLUORIDE		0.11	MG/L									
						4	0	4	0%	0.15	0.04	5.145		0.37
MW23	15-Dec-93	IRON, DISSOLVED		11000	ug/L									
MW23	16-Mar-94	IRON, DISSOLVED		120	ug/L									
MW23	16-Jun-94	IRON, DISSOLVED		17000	ug/L									
MW23	14-Sep-94	IRON, DISSOLVED		30000	UG/L									
						4	0	4	0%	14530.00	10788.08	5.145		70035
MW23	15-Dec-93	LEAD, DISSOLVED	<	3	ug/L									
MW23	16-Mar-94	LEAD, DISSOLVED	<	3	ug/L									
MW23	16-Jun-94	LEAD, DISSOLVED	<	3	ug/L									
MW23	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L									
MW23	15-Dec-93	MANGANESE, DISSOLVED		5200	ug/L									
MW23	16-Mar-94	MANGANESE, DISSOLVED		4400	ug/L									
MW23	16-Jun-94	MANGANESE, DISSOLVED		4000	ug/L									
MW23	14-Sep-94	MANGANESE, DISSOLVED		3700	UG/L									
						4	0	4	0%	4325.00	562.92	5.145		7221
MW23	15-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L									
MW23	16-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW23	16-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L									
MW23	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L									
MW23	15-Dec-93	NICKEL, DISSOLVED	<	40	ug/L									
MW23	16-Mar-94	NICKEL, DISSOLVED	<	40	ug/L									
MW23	16-Jun-94	NICKEL, DISSOLVED	<	40	ug/L									
MW23	14-Sep-94	NICKEL, DISSOLVED	<	40	UG/L									
MW23	15-Dec-93	NITROGEN, NITRATE	<	0.05	mg/L									
MW23	16-Mar-94	NITROGEN, NITRATE		0.22	mg/L									
MW23	16-Jun-94	NITROGEN, NITRATE	<	0.05	mg/L									
MW23	14-Sep-94	NITROGEN, NITRATE	<	0.05	MG/L									
MW23	15-Dec-93	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L									
MW23	16-Mar-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L									
MW23	16-Jun-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L									
MW23	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	MG/L									
MW23	15-Dec-93	SELENIUM, DISSOLVED	<	3	ug/L									
MW23	16-Mar-94	SELENIUM, DISSOLVED	<	12	ug/L									
MW23	16-Jun-94	SELENIUM, DISSOLVED	<	3	ug/L									
MW23	14-Sep-94	SELENIUM, DISSOLVED	<	6	UG/L									
MW23	15-Dec-93	SILVER, DISSOLVED	<	1	ug/L									
MW23	16-Mar-94	SILVER, DISSOLVED	<	1	ug/L									
MW23	16-Jun-94	SILVER, DISSOLVED	<	1	ug/L									
MW23	14-Sep-94	SILVER, DISSOLVED	<	1	UG/L									

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TABLE E3
CALCULATION OF TOLERANCE INTERVALS FOR SIDEGRADIENT SPOILS WELL MW-23
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

Well No.	Date	Parameter	Prefix	Result Units	Number of Results	Number of Non-detects	Number of Detects	Percentage of Non-detects	Mean	Standard Deviation	T-Value	Lower 95% Confidence	Upper 95% Confidence
MW23	15-Dec-93	SODIUM, DISSOLVED		41000 ug/L									
MW23	16-Mar-94	SODIUM, DISSOLVED		12000 ug/L									
MW23	16-Jun-94	SODIUM, DISSOLVED		17000 ug/L									
MW23	14-Sep-94	SODIUM, DISSOLVED		8800 UG/L									
					4	0	4	0%	19700.00	12640.02	5.145		84733
MW23	15-Dec-93	SULFATE		1200 mg/L									
MW23	16-Mar-94	SULFATE		280 mg/L									
MW23	16-Jun-94	SULFATE		750 mg/L									
MW23	14-Sep-94	SULFATE		170 MG/L									
					4	0	4	0%	600.00	409.21	5.145		2705
MW23	14-Sep-94	SULFIDE	<	1 MG/L									
MW23	15-Dec-93	SULFIDE, TOTAL	<	1 mg/L									
MW23	16-Mar-94	SULFIDE, TOTAL	<	1 mg/L									
MW23	16-Jun-94	SULFIDE, TOTAL	<	1 mg/L									
MW23	15-Dec-93	THALLIUM, DISSOLVED	<	3 mg/L									
MW23	15-Dec-93	TIN, DISSOLVED	<	500 ug/L									
MW23	16-Mar-94	TIN, DISSOLVED	<	500 ug/L									
MW23	16-Jun-94	TIN, DISSOLVED	<	500 ug/L									
MW23	14-Sep-94	TIN, DISSOLVED	<	500 UG/L									
MW23	15-Dec-93	TOTAL ORGANIC CARBON AS NPOC		1.1 mg/L									
MW23	16-Mar-94	TOTAL ORGANIC CARBON AS NPOC		0.66 mg/L									
MW23	16-Jun-94	TOTAL ORGANIC CARBON AS NPOC		0.77 mg/L									
MW23	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		1.2 MG/L									
					4	0	4	0%	0.93	0.22	5.145		2.1
MW23	15-Dec-93	TOTAL ORGANIC HALIDES	<	5 ug/L									
MW23	16-Mar-94	TOTAL ORGANIC HALIDES	<	5 ug/L									
MW23	16-Jun-94	TOTAL ORGANIC HALIDES		8.3 ug/L									
MW23	14-Sep-94	TOTAL ORGANIC HALIDES		11 UG/L									
MW23	15-Dec-93	VANADIUM, DISSOLVED	<	50 ug/L									
MW23	15-Dec-93	ZINC, DISSOLVED	<	20 ug/L									
MW23	16-Mar-94	ZINC, DISSOLVED		21 ug/L									
MW23	16-Jun-94	ZINC, DISSOLVED		46 ug/L									
MW23	14-Sep-94	ZINC, DISSOLVED		59 UG/L									
					4	1	3	25%	36.50	16.65	5.145		122
MW23	15-Dec-93	pH, FIELD		6.9 SU									
MW23	16-Mar-94	pH, FIELD		3 SU									
MW23	16-Jun-94	pH, FIELD		6.4 SU									
MW23	14-Sep-94	pH, FIELD		6.3 SU									
					4	0	4	0%	5.65	1.55	5.145	-2.30814	13.6

Table E-4

Comparison of Downgradient and

Sidegradient Groundwater Quality - Spoils Wells

TABLE E4
COMPARISON OF DOWNGRADIENT AND SIDEGRADIENT GROUNDWATER QUALITY - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW04A	16-Dec-93	ALKALINITY, BICARBONATE		350	mg/L	423		
MW04A	15-Mar-94	ALKALINITY, BICARBONATE		480	mg/L	423		YES
MW04A	16-Jun-94	ALKALINITY, BICARBONATE		450	mg/L	423		YES
MW13	15-Dec-93	ALKALINITY, BICARBONATE		76	mg/L	423		
MW13	15-Mar-94	ALKALINITY, BICARBONATE		44	mg/L	423		
MW13	15-Jun-94	ALKALINITY, BICARBONATE		42	mg/L	423		
MW21	16-Dec-93	ALKALINITY, BICARBONATE		360	mg/L	423		
MW21	15-Mar-94	ALKALINITY, BICARBONATE		360	mg/L	423		
MW21	17-Jun-94	ALKALINITY, BICARBONATE		360	mg/L	423		
MW22	15-Dec-93	ALKALINITY, BICARBONATE		150	mg/L	423		
MW22	15-Mar-94	ALKALINITY, BICARBONATE		130	mg/L	423		
MW22	16-Jun-94	ALKALINITY, BICARBONATE		160	mg/L	423		
MW04A	16-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW04A	15-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW04A	16-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW04A	14-Sep-94	ALKALINITY, CARBONATE		420	MG/L	55		YES
MW13	15-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW13	15-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW13	15-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW13	14-Sep-94	ALKALINITY, CARBONATE	<	20	MG/L	55		
MW21	16-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW21	15-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW21	17-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW21	14-Sep-94	ALKALINITY, CARBONATE		350	MG/L	55		YES
MW22	15-Dec-93	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW22	15-Mar-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW22	15-Jun-94	ALKALINITY, CARBONATE	<	20	mg/L	55		
MW22	14-Sep-94	ALKALINITY, CARBONATE		140	MG/L	55		YES
Proportions Test			13	16				
No. of Background Detects (x)			1					
No. of Background Samples (n)			4					
Proportion of Detects (Pu)			0.25					
No. of Downgradient Detects (y)			3					
No. of Downgradient Samples (m)			16					
Proportion of Detects (Pd)			0.19					
Standard of Error			0.2236					
Z Statistic (Z)			0.2795	No Difference				
MW04A	16-Dec-93	ANTIMONY, DISSOLVED		14	ug/L			
MW04A	15-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW04A	16-Jun-94	ANTIMONY, DISSOLVED		11	ug/L			
MW04A	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L			
MW13	15-Dec-93	ANTIMONY, DISSOLVED	<	3	ug/L			
MW13	15-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW13	15-Jun-94	ANTIMONY, DISSOLVED		12	ug/L			
MW13	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L			
MW21	16-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L			
MW21	15-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW21	17-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW21	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L			
MW22	15-Dec-93	ANTIMONY, DISSOLVED	<	10	ug/L			
MW22	15-Mar-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW22	15-Jun-94	ANTIMONY, DISSOLVED	<	10	ug/L			
MW22	14-Sep-94	ANTIMONY, DISSOLVED	<	10	UG/L			
MW04A	16-Dec-93	ARSENIC, DISSOLVED		3.5	ug/L			
MW04A	15-Mar-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW04A	16-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW04A	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L			
MW13	15-Dec-93	ARSENIC, DISSOLVED	<	10	ug/L			
MW13	15-Mar-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW13	15-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW13	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L			
MW21	16-Dec-93	ARSENIC, DISSOLVED		4.5	ug/L			
MW21	15-Mar-94	ARSENIC, DISSOLVED		6.8	ug/L			
MW21	17-Jun-94	ARSENIC, DISSOLVED		5.9	ug/L			
MW21	14-Sep-94	ARSENIC, DISSOLVED		7.8	UG/L			
MW22	15-Dec-93	ARSENIC, DISSOLVED	<	3	ug/L			
MW22	15-Mar-94	ARSENIC, DISSOLVED		5.5	ug/L			
MW22	15-Jun-94	ARSENIC, DISSOLVED	<	3	ug/L			
MW22	14-Sep-94	ARSENIC, DISSOLVED	<	3	UG/L			
MW04A	16-Dec-93	BARIUM, DISSOLVED	<	50	ug/L			
MW04A	15-Mar-94	BARIUM, DISSOLVED	<	50	ug/L			
MW04A	16-Jun-94	BARIUM, DISSOLVED	<	50	ug/L			

TABLE E4
COMPARISON OF DOWNGRADIENT AND SIDEGRADIENT GROUNDWATER QUALITY - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW04A	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L			
MW13	15-Dec-93	BARIUM, DISSOLVED	<	50	ug/L			
MW13	15-Mar-94	BARIUM, DISSOLVED	<	50	ug/L			
MW13	15-Jun-94	BARIUM, DISSOLVED	<	50	ug/L			
MW13	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L			
MW21	16-Dec-93	BARIUM, DISSOLVED	<	50	ug/L			
MW21	15-Mar-94	BARIUM, DISSOLVED	<	50	ug/L			
MW21	17-Jun-94	BARIUM, DISSOLVED	<	50	ug/L			
MW21	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L			
MW22	15-Dec-93	BARIUM, DISSOLVED	<	50	ug/L			
MW22	15-Mar-94	BARIUM, DISSOLVED	<	50	ug/L			
MW22	15-Jun-94	BARIUM, DISSOLVED	<	50	ug/L			
MW22	14-Sep-94	BARIUM, DISSOLVED	<	50	UG/L			
MW04A	16-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L			
MW13	15-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L			
MW21	16-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L			
MW22	15-Dec-93	BERYLLIUM, DISSOLVED	<	5	ug/L			
MW04A	16-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L	10.8		
MW04A	15-Mar-94	CADMIUM, DISSOLVED		0.67	ug/L	10.8		
MW04A	16-Jun-94	CADMIUM, DISSOLVED	<	0.3	ug/L	10.8		
MW04A	14-Sep-94	CADMIUM, DISSOLVED	<	0.3	UG/L	10.8		
MW13	15-Dec-93	CADMIUM, DISSOLVED		0.96	ug/L	10.8		
MW13	15-Mar-94	CADMIUM, DISSOLVED		4.3	ug/L	10.8		
MW13	15-Jun-94	CADMIUM, DISSOLVED		2.3	ug/L	10.8		
MW13	14-Sep-94	CADMIUM, DISSOLVED		0.96	UG/L	10.8		
MW21	16-Dec-93	CADMIUM, DISSOLVED		0.32	ug/L	10.8		
MW21	15-Mar-94	CADMIUM, DISSOLVED	<	0.3	ug/L	10.8		
MW21	17-Jun-94	CADMIUM, DISSOLVED	<	0.3	ug/L	10.8		
MW21	14-Sep-94	CADMIUM, DISSOLVED		0.35	UG/L	10.8		
MW22	15-Dec-93	CADMIUM, DISSOLVED	<	0.3	ug/L	10.8		
MW22	15-Mar-94	CADMIUM, DISSOLVED	<	0.3	ug/L	10.8		
MW22	15-Jun-94	CADMIUM, DISSOLVED	<	0.3	ug/L	10.8		
MW22	14-Sep-94	CADMIUM, DISSOLVED	<	0.3	UG/L	10.8		
MW04A	16-Dec-93	CHLORIDE		5.6	mg/L	633		
MW04A	15-Mar-94	CHLORIDE		15	mg/L	633		
MW04A	16-Jun-94	CHLORIDE		8.5	mg/L	633		
MW04A	14-Sep-94	CHLORIDE		11	MG/L	633		
MW13	15-Dec-93	CHLORIDE		50	mg/L	633		
MW13	15-Mar-94	CHLORIDE		45	mg/L	633		
MW13	15-Jun-94	CHLORIDE		69	mg/L	633		
MW13	14-Sep-94	CHLORIDE		78	MG/L	633		
MW21	16-Dec-93	CHLORIDE		52	mg/L	633		
MW21	15-Mar-94	CHLORIDE		54	mg/L	633		
MW21	17-Jun-94	CHLORIDE		42	mg/L	633		
MW21	14-Sep-94	CHLORIDE		60	MG/L	633		
MW22	15-Dec-93	CHLORIDE		34	mg/L	633		
MW22	15-Mar-94	CHLORIDE		44	mg/L	633		
MW22	15-Jun-94	CHLORIDE		42	mg/L	633		
MW22	14-Sep-94	CHLORIDE		33	MG/L	633		
MW13	14-Sep-94	CHLOROFORM	<	10	UG/L			
MW21	14-Sep-94	CHLOROFORM	<	10	UG/L			
MW22	14-Sep-94	CHLOROFORM	<	10	UG/L			
MW04A	16-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L			
MW04A	15-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW04A	16-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW04A	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L			
MW13	15-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L			
MW13	15-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW13	15-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW13	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L			
MW21	16-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L			
MW21	15-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW21	17-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW21	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L			
MW22	15-Dec-93	CHROMIUM, DISSOLVED	<	2	ug/L			
MW22	15-Mar-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW22	15-Jun-94	CHROMIUM, DISSOLVED	<	2	ug/L			
MW22	14-Sep-94	CHROMIUM, DISSOLVED	<	2	UG/L			
MW04A	16-Dec-93	COBALT, DISSOLVED		66	ug/L			
MW04A	15-Mar-94	COBALT, DISSOLVED		72	ug/L			
MW04A	16-Jun-94	COBALT, DISSOLVED		63	ug/L			

TABLE E4
COMPARISON OF DOWNGRADIENT AND SIDEGRADIENT GROUNDWATER QUALITY - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW04A	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L			
MW13	15-Dec-93	COBALT, DISSOLVED		120	ug/L			
MW13	15-Mar-94	COBALT, DISSOLVED		100	ug/L			
MW13	15-Jun-94	COBALT, DISSOLVED		130	ug/L			
MW13	14-Sep-94	COBALT, DISSOLVED		110	UG/L			
MW21	16-Dec-93	COBALT, DISSOLVED	<	50	ug/L			
MW21	15-Mar-94	COBALT, DISSOLVED	<	50	ug/L			
MW21	17-Jun-94	COBALT, DISSOLVED	<	50	ug/L			
MW21	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L			
MW22	15-Dec-93	COBALT, DISSOLVED	<	50	ug/L			
MW22	15-Mar-94	COBALT, DISSOLVED	<	50	ug/L			
MW22	15-Jun-94	COBALT, DISSOLVED	<	50	ug/L			
MW22	14-Sep-94	COBALT, DISSOLVED	<	50	UG/L			
MW04A	16-Dec-93	CONDUCTANCE, SPECIFIC		2100	UMHOS/CM	3488		
MW04A	15-Mar-94	CONDUCTANCE, SPECIFIC		1690	UMHOS/CM	3488		
MW04A	16-Jun-94	CONDUCTANCE, SPECIFIC		1890	UMHOS/CM	3488		
MW13	15-Dec-93	CONDUCTANCE, SPECIFIC		2000	UMHOS/CM	3488		
MW13	15-Mar-94	CONDUCTANCE, SPECIFIC		1790	UMHOS/CM	3488		
MW13	15-Jun-94	CONDUCTANCE, SPECIFIC		2050	UMHOS/CM	3488		
MW21	16-Dec-93	CONDUCTANCE, SPECIFIC		2700	UMHOS/CM	3488		
MW21	15-Mar-94	CONDUCTANCE, SPECIFIC		2620	UMHOS/CM	3488		
MW21	17-Jun-94	CONDUCTANCE, SPECIFIC		2600	UMHOS/CM	3488		
MW22	15-Dec-93	CONDUCTANCE, SPECIFIC		1500	UMHOS/CM	3488		
MW22	15-Mar-94	CONDUCTANCE, SPECIFIC		1060	UMHOS/CM	3488		
MW22	15-Jun-94	CONDUCTANCE, SPECIFIC		1340	UMHOS/CM	3488		
MW04A	16-Dec-93	COPPER, DISSOLVED		4.4	ug/L			
MW04A	15-Mar-94	COPPER, DISSOLVED	<	3	ug/L			
MW04A	16-Jun-94	COPPER, DISSOLVED	<	3	ug/L			
MW04A	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L			
MW13	15-Dec-93	COPPER, DISSOLVED	<	3	ug/L			
MW13	15-Mar-94	COPPER, DISSOLVED	<	3	ug/L			
MW13	15-Jun-94	COPPER, DISSOLVED	<	3	ug/L			
MW13	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L			
MW21	16-Dec-93	COPPER, DISSOLVED	<	3	ug/L			
MW21	15-Mar-94	COPPER, DISSOLVED	<	3	ug/L			
MW21	17-Jun-94	COPPER, DISSOLVED	<	3	ug/L			
MW21	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L			
MW22	15-Dec-93	COPPER, DISSOLVED	<	3	ug/L			
MW22	15-Mar-94	COPPER, DISSOLVED	<	6.3	ug/L			
MW22	15-Jun-94	COPPER, DISSOLVED	<	3	ug/L			
MW22	14-Sep-94	COPPER, DISSOLVED	<	3	UG/L			
MW04A	16-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L			
MW13	15-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L			
MW21	16-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L			
MW22	15-Dec-93	CYANIDE, TOTAL	<	0.01	mg/L			
MW04A	16-Dec-93	FLUORIDE		0.17	mg/L	0.37		
MW04A	15-Mar-94	FLUORIDE		0.17	mg/L	0.37		
MW04A	16-Jun-94	FLUORIDE		0.2	mg/L	0.37		
MW04A	14-Sep-94	FLUORIDE		0.24	MG/L	0.37		
MW13	15-Dec-93	FLUORIDE		0.36	mg/L	0.37		
MW13	15-Mar-94	FLUORIDE		0.38	mg/L	0.37		YES
MW13	15-Jun-94	FLUORIDE		0.84	mg/L	0.37		YES
MW13	14-Sep-94	FLUORIDE		0.88	MG/L	0.37		YES
MW21	16-Dec-93	FLUORIDE		0.49	mg/L	0.37		YES
MW21	15-Mar-94	FLUORIDE		0.55	mg/L	0.37		YES
MW21	17-Jun-94	FLUORIDE		0.65	mg/L	0.37		YES
MW21	14-Sep-94	FLUORIDE		0.66	MG/L	0.37		YES
MW22	15-Dec-93	FLUORIDE		0.45	mg/L	0.37		YES
MW22	15-Mar-94	FLUORIDE		0.66	mg/L	0.37		YES
MW22	15-Jun-94	FLUORIDE		0.5	mg/L	0.37		YES
MW22	14-Sep-94	FLUORIDE		0.6	MG/L	0.37		YES
MW04A	16-Dec-93	IRON, DISSOLVED		39000	ug/L	70035		
MW04A	15-Mar-94	IRON, DISSOLVED		14000	ug/L	70035		
MW04A	16-Jun-94	IRON, DISSOLVED		18000	ug/L	70035		
MW04A	14-Sep-94	IRON, DISSOLVED		4900	UG/L	70035		
MW13	15-Dec-93	IRON, DISSOLVED		32000	ug/L	70035		
MW13	15-Mar-94	IRON, DISSOLVED		27000	ug/L	70035		
MW13	15-Jun-94	IRON, DISSOLVED		24000	ug/L	70035		
MW13	14-Sep-94	IRON, DISSOLVED		30000	UG/L	70035		
MW21	16-Dec-93	IRON, DISSOLVED		35000	ug/L	70035		
MW21	15-Mar-94	IRON, DISSOLVED		34000	ug/L	70035		
MW21	17-Jun-94	IRON, DISSOLVED		35000	ug/L	70035		

TABLE E4
COMPARISON OF DOWNGRADIENT AND SIDEGRADIENT GROUNDWATER QUALITY - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW21	14-Sep-94	IRON, DISSOLVED		35000	UG/L	70035		
MW22	15-Dec-93	IRON, DISSOLVED		16000	ug/L	70035		
MW22	15-Mar-94	IRON, DISSOLVED		15000	ug/L	70035		
MW22	15-Jun-94	IRON, DISSOLVED		17000	ug/L	70035		
MW22	14-Sep-94	IRON, DISSOLVED		17000	UG/L	70035		
MW04A	16-Dec-93	LEAD, DISSOLVED	<	3	ug/L			
MW04A	15-Mar-94	LEAD, DISSOLVED	<	3	ug/L			
MW04A	16-Jun-94	LEAD, DISSOLVED	<	3	ug/L			
MW04A	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L			
MW13	15-Dec-93	LEAD, DISSOLVED	<	3	ug/L			
MW13	15-Mar-94	LEAD, DISSOLVED	<	3	ug/L			
MW13	15-Jun-94	LEAD, DISSOLVED	<	3	ug/L			
MW13	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L			
MW21	16-Dec-93	LEAD, DISSOLVED	<	3	ug/L			
MW21	15-Mar-94	LEAD, DISSOLVED	<	3	ug/L			
MW21	17-Jun-94	LEAD, DISSOLVED	<	3	ug/L			
MW21	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L			
MW22	15-Dec-93	LEAD, DISSOLVED	<	3	ug/L			
MW22	15-Mar-94	LEAD, DISSOLVED	<	3	ug/L			
MW22	15-Jun-94	LEAD, DISSOLVED	<	3	ug/L			
MW22	14-Sep-94	LEAD, DISSOLVED	<	3	UG/L			
MW04A	16-Dec-93	MANGANESE, DISSOLVED		7800	ug/L	7221		YES
MW04A	15-Mar-94	MANGANESE, DISSOLVED		6200	ug/L	7221		
MW04A	16-Jun-94	MANGANESE, DISSOLVED		5500	ug/L	7221		
MW04A	14-Sep-94	MANGANESE, DISSOLVED		4000	UG/L	7221		
MW13	15-Dec-93	MANGANESE, DISSOLVED		13000	ug/L	7221		YES
MW13	15-Mar-94	MANGANESE, DISSOLVED		11000	ug/L	7221		YES
MW13	15-Jun-94	MANGANESE, DISSOLVED		15000	ug/L	7221		YES
MW13	14-Sep-94	MANGANESE, DISSOLVED		12000	UG/L	7221		YES
MW21	16-Dec-93	MANGANESE, DISSOLVED		13000	ug/L	7221		YES
MW21	15-Mar-94	MANGANESE, DISSOLVED		11000	ug/L	7221		YES
MW21	17-Jun-94	MANGANESE, DISSOLVED		14000	ug/L	7221		YES
MW21	14-Sep-94	MANGANESE, DISSOLVED		10000	UG/L	7221		YES
MW22	15-Dec-93	MANGANESE, DISSOLVED		8000	ug/L	7221		YES
MW22	15-Mar-94	MANGANESE, DISSOLVED		5900	ug/L	7221		
MW22	15-Jun-94	MANGANESE, DISSOLVED		6000	ug/L	7221		
MW22	14-Sep-94	MANGANESE, DISSOLVED		5500	UG/L	7221		
MW04A	16-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L			
MW04A	15-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW04A	16-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW04A	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L			
MW13	15-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L			
MW13	15-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW13	15-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW13	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L			
MW21	16-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L			
MW21	15-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW21	17-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW21	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L			
MW22	15-Dec-93	MERCURY, DISSOLVED	<	0.2	ug/L			
MW22	15-Mar-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW22	15-Jun-94	MERCURY, DISSOLVED	<	0.2	ug/L			
MW22	14-Sep-94	MERCURY, DISSOLVED	<	0.2	UG/L			
MW04A	16-Dec-93	NICKEL, DISSOLVED		82	ug/L			
MW04A	15-Mar-94	NICKEL, DISSOLVED		79	ug/L			
MW04A	16-Jun-94	NICKEL, DISSOLVED		59	ug/L			
MW04A	14-Sep-94	NICKEL, DISSOLVED	<	40	UG/L			
MW13	15-Dec-93	NICKEL, DISSOLVED		160	ug/L			
MW13	15-Mar-94	NICKEL, DISSOLVED		150	ug/L			
MW13	15-Jun-94	NICKEL, DISSOLVED		210	ug/L			
MW13	14-Sep-94	NICKEL, DISSOLVED		160	UG/L			
MW21	16-Dec-93	NICKEL, DISSOLVED	<	40	ug/L			
MW21	15-Mar-94	NICKEL, DISSOLVED	<	40	ug/L			
MW21	17-Jun-94	NICKEL, DISSOLVED	<	40	ug/L			
MW21	14-Sep-94	NICKEL, DISSOLVED	<	40	UG/L			
MW22	15-Dec-93	NICKEL, DISSOLVED		44	ug/L			
MW22	15-Mar-94	NICKEL, DISSOLVED	<	40	ug/L			
MW22	15-Jun-94	NICKEL, DISSOLVED	<	40	ug/L			
MW22	14-Sep-94	NICKEL, DISSOLVED	<	40	UG/L			
MW04A	16-Dec-93	NITROGEN, NITRATE	<	0.05	mg/L			
MW04A	15-Mar-94	NITROGEN, NITRATE	<	0.5	mg/L			
MW04A	16-Jun-94	NITROGEN, NITRATE	<	0.05	mg/L			

TABLE E4
COMPARISON OF DOWNGRADIENT AND SIDEGRADIENT GROUNDWATER QUALITY - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW04A	14-Sep-94	NITROGEN, NITRATE	<	0.05	MG/L			
MW13	15-Dec-93	NITROGEN, NITRATE	<	0.05	mg/L			
MW13	15-Mar-94	NITROGEN, NITRATE	<	0.05	mg/L			
MW13	15-Jun-94	NITROGEN, NITRATE	<	0.05	mg/L			
MW13	14-Sep-94	NITROGEN, NITRATE	<	0.05	MG/L			
MW21	16-Dec-93	NITROGEN, NITRATE	<	0.05	mg/L			
MW21	15-Mar-94	NITROGEN, NITRATE	<	0.05	mg/L			
MW21	17-Jun-94	NITROGEN, NITRATE	<	0.05	mg/L			
MW21	14-Sep-94	NITROGEN, NITRATE	<	0.05	MG/L			
MW22	15-Dec-93	NITROGEN, NITRATE	<	0.05	mg/L			
MW22	15-Mar-94	NITROGEN, NITRATE	<	0.05	mg/L			
MW22	15-Jun-94	NITROGEN, NITRATE	<	0.05	mg/L			
MW22	14-Sep-94	NITROGEN, NITRATE	<	0.05	MG/L			
MW04A	16-Dec-93	PHENOLICS, TOTAL RECOVERABLE		0.013	mg/L			
MW04A	15-Mar-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW04A	16-Jun-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW04A	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	MG/L			
MW13	15-Dec-93	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW13	15-Mar-94	PHENOLICS, TOTAL RECOVERABLE		0.012	mg/L			
MW13	15-Jun-94	PHENOLICS, TOTAL RECOVERABLE		0.02	mg/L			
MW13	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	MG/L			
MW21	16-Dec-93	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW21	15-Mar-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW21	17-Jun-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW21	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	MG/L			
MW22	15-Dec-93	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW22	15-Mar-94	PHENOLICS, TOTAL RECOVERABLE	<	0.01	mg/L			
MW22	15-Jun-94	PHENOLICS, TOTAL RECOVERABLE		0.011	mg/L			
MW22	14-Sep-94	PHENOLICS, TOTAL RECOVERABLE		0.012	MG/L			
MW04A	16-Dec-93	SELENIUM, DISSOLVED	<	3	ug/L			
MW04A	15-Mar-94	SELENIUM, DISSOLVED	<	12	ug/L			
MW04A	16-Jun-94	SELENIUM, DISSOLVED	<	3	ug/L			
MW04A	14-Sep-94	SELENIUM, DISSOLVED	<	6	UG/L			
MW13	15-Dec-93	SELENIUM, DISSOLVED	<	3	ug/L			
MW13	15-Mar-94	SELENIUM, DISSOLVED	<	12	ug/L			
MW13	15-Jun-94	SELENIUM, DISSOLVED	<	6	ug/L			
MW13	14-Sep-94	SELENIUM, DISSOLVED	<	6	UG/L			
MW21	16-Dec-93	SELENIUM, DISSOLVED	<	3	ug/L			
MW21	15-Mar-94	SELENIUM, DISSOLVED	<	12	ug/L			
MW21	17-Jun-94	SELENIUM, DISSOLVED	<	3	ug/L			
MW21	14-Sep-94	SELENIUM, DISSOLVED	<	6	UG/L			
MW22	15-Dec-93	SELENIUM, DISSOLVED	<	3	ug/L			
MW22	15-Mar-94	SELENIUM, DISSOLVED	<	12	ug/L			
MW22	15-Jun-94	SELENIUM, DISSOLVED	<	6	ug/L			
MW22	14-Sep-94	SELENIUM, DISSOLVED	<	6	UG/L			
MW04A	16-Dec-93	SILVER, DISSOLVED	<	1	ug/L			
MW04A	15-Mar-94	SILVER, DISSOLVED	<	1	ug/L			
MW04A	16-Jun-94	SILVER, DISSOLVED	<	1	ug/L			
MW04A	14-Sep-94	SILVER, DISSOLVED	<	1	UG/L			
MW13	15-Dec-93	SILVER, DISSOLVED	<	1	ug/L			
MW13	15-Mar-94	SILVER, DISSOLVED	<	1	ug/L			
MW13	15-Jun-94	SILVER, DISSOLVED	<	1	ug/L			
MW13	14-Sep-94	SILVER, DISSOLVED	<	1	UG/L			
MW21	16-Dec-93	SILVER, DISSOLVED	<	1	ug/L			
MW21	15-Mar-94	SILVER, DISSOLVED	<	1	ug/L			
MW21	17-Jun-94	SILVER, DISSOLVED	<	1	ug/L			
MW21	14-Sep-94	SILVER, DISSOLVED	<	1	UG/L			
MW22	15-Dec-93	SILVER, DISSOLVED	<	1	ug/L			
MW22	15-Mar-94	SILVER, DISSOLVED	<	1	ug/L			
MW22	15-Jun-94	SILVER, DISSOLVED	<	1	ug/L			
MW22	14-Sep-94	SILVER, DISSOLVED	<	1	UG/L			
MW04A	16-Dec-93	SODIUM, DISSOLVED		31000	ug/L	84733		
MW04A	15-Mar-94	SODIUM, DISSOLVED		31000	ug/L	84733		
MW04A	16-Jun-94	SODIUM, DISSOLVED		30000	ug/L	84733		
MW04A	14-Sep-94	SODIUM, DISSOLVED		32000	UG/L	84733		
MW13	15-Dec-93	SODIUM, DISSOLVED		37000	ug/L	84733		
MW13	15-Mar-94	SODIUM, DISSOLVED		33000	ug/L	84733		
MW13	15-Jun-94	SODIUM, DISSOLVED		40000	ug/L	84733		
MW13	14-Sep-94	SODIUM, DISSOLVED		42000	UG/L	84733		
MW21	16-Dec-93	SODIUM, DISSOLVED		130000	ug/L	84733		YES
MW21	15-Mar-94	SODIUM, DISSOLVED		130000	ug/L	84733		YES
MW21	17-Jun-94	SODIUM, DISSOLVED		130000	ug/L	84733		YES
MW21	14-Sep-94	SODIUM, DISSOLVED		120000	UG/L	84733		YES

TABLE E4
COMPARISON OF DOWNGRADIENT AND SIDEGRADIENT GROUNDWATER QUALITY - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW22	15-Dec-93	SODIUM, DISSOLVED		40000	ug/L	84733		
MW22	15-Mar-94	SODIUM, DISSOLVED		39000	ug/L	84733		
MW22	15-Jun-94	SODIUM, DISSOLVED		43000	ug/L	84733		
MW22	14-Sep-94	SODIUM, DISSOLVED		41000	UG/L	84733		
MW04A	16-Dec-93	SULFATE		870	mg/L	2705		
MW04A	15-Mar-94	SULFATE		600	mg/L	2705		
MW04A	16-Jun-94	SULFATE		620	mg/L	2705		
MW04A	14-Sep-94	SULFATE		980	MG/L	2705		
MW13	15-Dec-93	SULFATE		1100	mg/L	2705		
MW13	15-Mar-94	SULFATE		970	mg/L	2705		
MW13	15-Jun-94	SULFATE		1100	mg/L	2705		
MW13	14-Sep-94	SULFATE		930	MG/L	2705		
MW21	16-Dec-93	SULFATE		1300	mg/L	2705		
MW21	15-Mar-94	SULFATE		1200	mg/L	2705		
MW21	17-Jun-94	SULFATE		1200	mg/L	2705		
MW21	14-Sep-94	SULFATE		1200	MG/L	2705		
MW22	15-Dec-93	SULFATE		500	mg/L	2705		
MW22	15-Mar-94	SULFATE		420	mg/L	2705		
MW22	15-Jun-94	SULFATE		500	mg/L	2705		
MW22	14-Sep-94	SULFATE		400	MG/L	2705		
MW04A	14-Sep-94	SULFIDE	<	1	MG/L			
MW13	14-Sep-94	SULFIDE	<	1	MG/L			
MW21	14-Sep-94	SULFIDE		4	MG/L			
MW22	14-Sep-94	SULFIDE	<	1	MG/L			
MW04A	16-Dec-93	SULFIDE, TOTAL	<	1	mg/L			
MW04A	15-Mar-94	SULFIDE, TOTAL		1.7	mg/L			
MW04A	16-Jun-94	SULFIDE, TOTAL		2.1	mg/L			
MW13	15-Dec-93	SULFIDE, TOTAL		2	mg/L			
MW13	15-Mar-94	SULFIDE, TOTAL	<	1	mg/L			
MW13	15-Jun-94	SULFIDE, TOTAL	<	1	mg/L			
MW21	16-Dec-93	SULFIDE, TOTAL		3.1	mg/L			
MW21	15-Mar-94	SULFIDE, TOTAL	<	1	mg/L			
MW21	17-Jun-94	SULFIDE, TOTAL	<	1	mg/L			
MW22	15-Dec-93	SULFIDE, TOTAL		1.1	mg/L			
MW22	15-Mar-94	SULFIDE, TOTAL	<	1	mg/L			
MW22	15-Jun-94	SULFIDE, TOTAL	<	1	mg/L			
MW04A	16-Dec-93	THALLIUM, DISSOLVED	<	3	mg/L			
MW13	15-Dec-93	THALLIUM, DISSOLVED	<	3	mg/L			
MW21	16-Dec-93	THALLIUM, DISSOLVED	<	3	mg/L			
MW22	15-Dec-93	THALLIUM, DISSOLVED	<	3	mg/L			
MW04A	16-Dec-93	TIN, DISSOLVED	<	500	ug/L			
MW04A	15-Mar-94	TIN, DISSOLVED	<	500	ug/L			
MW04A	16-Jun-94	TIN, DISSOLVED	<	500	ug/L			
MW04A	14-Sep-94	TIN, DISSOLVED	<	500	UG/L			
MW13	15-Dec-93	TIN, DISSOLVED	<	500	ug/L			
MW13	15-Mar-94	TIN, DISSOLVED	<	500	ug/L			
MW13	15-Jun-94	TIN, DISSOLVED	<	500	ug/L			
MW13	14-Sep-94	TIN, DISSOLVED	<	500	UG/L			
MW21	16-Dec-93	TIN, DISSOLVED	<	500	ug/L			
MW21	15-Mar-94	TIN, DISSOLVED	<	500	ug/L			
MW21	17-Jun-94	TIN, DISSOLVED	<	500	ug/L			
MW21	14-Sep-94	TIN, DISSOLVED	<	500	UG/L			
MW22	15-Dec-93	TIN, DISSOLVED	<	500	ug/L			
MW22	15-Mar-94	TIN, DISSOLVED	<	500	ug/L			
MW22	15-Jun-94	TIN, DISSOLVED	<	500	ug/L			
MW22	14-Sep-94	TIN, DISSOLVED	<	500	UG/L			
MW04A	16-Dec-93	TOTAL ORGANIC CARBON AS NPOC		7	mg/L	2.1		YES
MW04A	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC		13	mg/L	2.1		YES
MW04A	16-Jun-94	TOTAL ORGANIC CARBON AS NPOC		2.4	mg/L	2.1		YES
MW04A	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		18	MG/L	2.1		YES
MW13	15-Dec-93	TOTAL ORGANIC CARBON AS NPOC		8.2	mg/L	2.1		YES
MW13	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC		4.3	mg/L	2.1		YES
MW13	15-Jun-94	TOTAL ORGANIC CARBON AS NPOC		3.3	mg/L	2.1		YES
MW13	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		24	MG/L	2.1		YES
MW21	16-Dec-93	TOTAL ORGANIC CARBON AS NPOC		15	mg/L	2.1		YES
MW21	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC		5.5	mg/L	2.1		YES
MW21	17-Jun-94	TOTAL ORGANIC CARBON AS NPOC		16	mg/L	2.1		YES
MW21	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		7.4	MG/L	2.1		YES
MW22	15-Dec-93	TOTAL ORGANIC CARBON AS NPOC		27	mg/L	2.1		YES
MW22	15-Mar-94	TOTAL ORGANIC CARBON AS NPOC		3.6	mg/L	2.1		YES
MW22	15-Jun-94	TOTAL ORGANIC CARBON AS NPOC		4	mg/L	2.1		YES
MW22	14-Sep-94	TOTAL ORGANIC CARBON AS NPOC		23	MG/L	2.1		YES

TABLE E4
COMPARISON OF DOWNGRADIENT AND SIDEGRADIENT GROUNDWATER QUALITY - SPOILS WELLS
AMERICAN STEEL FOUNDRIES
SEBRING FACILITY
DATA FROM FIRST FOUR QUARTERS

WELL ID.	DATE	PARAMETER	PREFIX	RESULT	UNITS	UPPER 95% CONFIDENCE LIMIT	LOWER 95% CONFIDENCE LIMIT	EXCEEDANCE?
MW04A	16-Dec-93	TOTAL ORGANIC HALIDES	<	5	ug/L			
MW04A	15-Mar-94	TOTAL ORGANIC HALIDES	<	5	ug/L			
MW04A	16-Jun-94	TOTAL ORGANIC HALIDES		5.9	ug/L			
MW04A	14-Sep-94	TOTAL ORGANIC HALIDES	<	5	UG/L			
MW13	15-Dec-93	TOTAL ORGANIC HALIDES		8.6	ug/L			
MW13	15-Mar-94	TOTAL ORGANIC HALIDES	<	5	ug/L			
MW13	15-Jun-94	TOTAL ORGANIC HALIDES		6.2	ug/L			
MW13	14-Sep-94	TOTAL ORGANIC HALIDES		14	UG/L			
MW21	16-Dec-93	TOTAL ORGANIC HALIDES		13	ug/L			
MW21	15-Mar-94	TOTAL ORGANIC HALIDES		25	ug/L			
MW21	17-Jun-94	TOTAL ORGANIC HALIDES		10	ug/L			
MW21	14-Sep-94	TOTAL ORGANIC HALIDES		13	UG/L			
MW22	15-Dec-93	TOTAL ORGANIC HALIDES		15	ug/L			
MW22	15-Mar-94	TOTAL ORGANIC HALIDES		9.6	ug/L			
MW22	15-Jun-94	TOTAL ORGANIC HALIDES		12	ug/L			
MW22	14-Sep-94	TOTAL ORGANIC HALIDES		17	UG/L			
MW04A	16-Dec-93	VANADIUM, DISSOLVED	<	50	ug/L			
MW13	15-Dec-93	VANADIUM, DISSOLVED	<	50	ug/L			
MW21	16-Dec-93	VANADIUM, DISSOLVED	<	50	ug/L			
MW22	15-Dec-93	VANADIUM, DISSOLVED	<	50	ug/L			
MW04A	16-Dec-93	ZINC, DISSOLVED		66	ug/L	122		
MW04A	15-Mar-94	ZINC, DISSOLVED		91	ug/L	122		
MW04A	16-Jun-94	ZINC, DISSOLVED		61	ug/L	122		
MW04A	14-Sep-94	ZINC, DISSOLVED		24	UG/L	122		
MW13	15-Dec-93	ZINC, DISSOLVED		250	ug/L	122		YES
MW13	15-Mar-94	ZINC, DISSOLVED		230	ug/L	122		YES
MW13	16-Jun-94	ZINC, DISSOLVED		370	ug/L	122		YES
MW13	14-Sep-94	ZINC, DISSOLVED		240	UG/L	122		YES
MW21	16-Dec-93	ZINC, DISSOLVED		32	ug/L	122		
MW21	15-Mar-94	ZINC, DISSOLVED	<	20	ug/L	122		
MW21	17-Jun-94	ZINC, DISSOLVED		24	ug/L	122		
MW21	14-Sep-94	ZINC, DISSOLVED		22	UG/L	122		
MW22	15-Dec-93	ZINC, DISSOLVED		40	ug/L	122		
MW22	15-Mar-94	ZINC, DISSOLVED	<	20	ug/L	122		
MW22	15-Jun-94	ZINC, DISSOLVED		25	ug/L	122		
MW22	14-Sep-94	ZINC, DISSOLVED		21	UG/L	122		
MW04A	16-Dec-93	pH, FIELD		6.4	SU	13.6		
MW04A	15-Mar-94	pH, FIELD		6	SU	13.6		
MW04A	16-Jun-94	pH, FIELD		6.2	SU	13.6		
MW13	15-Dec-93	pH, FIELD		5	SU	13.6		
MW13	15-Mar-94	pH, FIELD		5.1	SU	13.6		
MW13	15-Jun-94	pH, FIELD		5.4	SU	13.6		
MW21	16-Dec-93	pH, FIELD		6.4	SU	13.6		
MW21	15-Mar-94	pH, FIELD		6.2	SU	13.6		
MW21	17-Jun-94	pH, FIELD		6.4	SU	13.6		
MW22	15-Dec-93	pH, FIELD		6.3	SU	13.6		
MW22	15-Mar-94	pH, FIELD		5.9	SU	13.6		
MW22	15-Jun-94	pH, FIELD		6.3	SU	13.6		

TABLE 3-2 (CONTINUED)

APPENDIX IX - VOLATILE ORGANIC COMPOUNDS AND PRACTICAL QUANTITATION LIMITS (PQL's) FOR METHOD 8240

Compound	$\mu g/L$
2-Hexanone	10
Tetrachloroethene	5
1,1,2,2-Tetrachloroethane	5
Toluene	5
Chlorobenzene	5
Ethylbenzene	5
Styrene	5
Xylenes, Total	5
Dichlorodifluoromethane	5
Trichlorofluoromethane	5
Acrolein	100
Acrylonitrile	25
Iodomethane	5
3-Chloro-1-propene	5
Acetonitrile	50
2-Chloro-1,3-butadiene	5
Propionitrile	100
Methacrylonitrile	100
Isobutanol	100
Dibromomethane	5
1,2-Dibromoethane	5
1,1,1,2-Tetrachloroethane	5
1,4-Dichloro-2-butene	50
1,2,3-Trichloropropane	5
1,2-Dibromo-3-chloropropane	5

TABLE 3-2

APPENDIX IX - VOLATILE ORGANIC COMPOUNDS AND PRACTICAL QUANTITATION LIMITS (PQL's) FOR METHOD 8240

Compound	µg/L
Chloromethane	10
Bromomethane	10
Vinyl Chloride	10
Chloroethane	10
Methylene Chloride	5
Acetone	10
Carbon Disulfide	5
1,1-Dichloroethene	5
1,1-Dichloroethane	5
1,2-Dichloroethene (total)	5
Chloroform	5
1,2-Dichloroethane	5
2-Butanone	10
1,1,1-Trichloroethane	5
Carbon Tetrachloride	5
Vinyl Acetate	10
Bromodichloromethane	5
1,2-Dichloropropane	5
cis-1,3-Dichloropropene	5
Trichloroethene	5
Dibromochloromethane	5
1,1,2-Trichloroethane	5
Benzene	5
Trans-1,3-Dichloropropene	5
Bromoform	5
4-Methyl-2-Pentanone	10

Revised Table 3-3[1]

APPENDIX IX - METALS, METHODS OF ANALYSIS AND PRACTICAL QUANTITATION LIMITS (PQL's)

Analyte	PQL in $\mu g/L$	SW-846 Method
Antimony	10	7041
Arsenic[2]	3	7060
Barium[2]	50	6010
Cadmium[2]	0.3	7131
Chromium (total)[2]	2	7191
Cobalt	50	6010
Copper	3	7211
Lead[2]	3	7421
Mercury[2]	0.2	7470,7471
Nickel[2]	40	6010
Selenium[2]	3	7740
Silver[2]	1	7761
Tin	500	RMT Lab Internal
Zinc[2]	20	6010
Sulfide (total)	1000	9030

Notes:

(1) Table originally presented in Groundwater Sampling and Analysis Plan (RMT, 1992). Revised based on First Quarter groundwater sampling results.

(2) Compound or element is found in ASF wastestream.

TABLE 3-3

APPENDIX IX - METALS, METHODS OF ANALYSIS AND PRACTICAL QUANTITATION LIMITS (PQL's)

Analyte	PQL in $\mu g/L$	SW-846 Method
Antimony	10	7041
Arsenic	3	7060
Barium	50	6010
Beryllium	5	6010
Cadmium	0.3	7131
Chromium (total)	2	7191
Cobalt	50	6010
Copper	3	7211
Lead	3	7421
Mercury	0.2	7470,7471
Nickel	40	6010
Selenium	3	7740
Silver	1	7761
Thallium	3	7841
Tin	200	RMT Lab Internal
Vanadium	50	6010
Zinc	20	6010
Cyanide (total)	10	9012
Sulfide (total)	1000	9030

TABLE 3-5 COMPOUNDS FOUND IN ASF WASTESTREAM	
Arsenic	Lead
Barium	Manganese
Cadmium	Mercury
Chloride	Nickel
Chromium	Phenol
Fluoride	Selenium
Iron	Silver
Sulfate	Zinc

APPENDIX D
ANALYTICAL LABORATORY RESULTS

ANALYTICAL LABORATORY RESULTS
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES

Parameter	Units	MW-20 (DUP) 14-Sep-94	FIELD BLANK 14-Sep-94	MW-01A 14-Sep-94	MW-04A 14-Sep-94	MW-13 14-Sep-94	MW-14 14-Sep-94
ALKALINITY, CARBONATE	MG/L	290	< 20	< 20	420	< 20	200
ANTIMONY, DISSOLVED	UG/L	< 10	< 10	< 10	< 10	< 10	< 10
ARSENIC, DISSOLVED	UG/L	3.8	< 3	< 3	< 3	< 3	< 3
BARIUM, DISSOLVED	UG/L	< 50	< 50	< 50	< 50	< 50	< 50
CADMIUM, DISSOLVED	UG/L	< 0.3	< 0.3	1.6	< 0.3	0.96	< 0.3
CHLORIDE	MG/L	25	< 2	270	11	78	26
CHLOROFORM	UG/L	< 10	< 10	< 10	< 2	< 10	< 10
CHROMIUM, DISSOLVED	UG/L	< 2	< 2	2.5	< 50	< 2	< 2
COBALT, DISSOLVED	UG/L	< 50	< 50	< 50	< 3	110	< 50
COPPER, DISSOLVED	UG/L	< 3	< 3	34	0.24	< 3	< 3
FLUORIDE	MG/L	0.46	< 0.1	0.92	4900	0.88	0.34
IRON, DISSOLVED	UG/L	18000	< 100	34000	< 3	30000	1900
LEAD, DISSOLVED	UG/L	< 3	< 3	< 3	4000	< 3	< 3
MANGANESE, DISSOLVED	UG/L	7700	< 5	2700	< 0.2	12000	600
MERCURY, DISSOLVED	UG/L	< 0.2	< 0.2	< 0.2	< 40	< 0.2	< 0.2
NICKEL, DISSOLVED	UG/L	< 40	< 40	86	< 0.05	160	< 40
NITROGEN, NITRATE	MG/L	< 0.05	< 0.05	< 0.25	< 0.01	< 0.05	0.052
PHENOLICS, TOTAL RECOVERABLE	MG/L	< 0.01	< 0.01	< 0.01	< 6	< 0.01	0.02
SELENIUM, DISSOLVED	UG/L	< 6	< 6	< 6	< 1	< 6	< 6
SILVER, DISSOLVED	UG/L	< 1	< 1	< 1	32000	< 1	< 1
SODIUM, DISSOLVED	UG/L	110000	< 500	120000	980	42000	38000
SULFATE	MG/L	750	< 10	570	< 1	930	1200
SULFIDE	MG/L	1.2	< 1	< 1	< 500	< 1	< 1
TIN, DISSOLVED	UG/L	< 500	< 500	< 500	18	< 500	< 500
TOTAL ORGANIC CARBON AS NPOC	MG/L	13	< 0.25	17	< 5	24	9.3
TOTAL ORGANIC HALIDES	UG/L	6.8	< 5	17	24	14	62
ZINC, DISSOLVED	UG/L	< 20	< 20	150		240	< 20

ANALYTICAL LABORATORY RESULTS
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES

Parameters	Units	MW-19 14-Sep-94	MW-19P 14-Sep-94	MW-20 14-Sep-94	MW-21 14-Sep-94	MW-21P 14-Sep-94	MW-22 14-Sep-94
ALKALINITY, CARBONATE	MG/L	< 20		290	350	380	< 140
ANTIMONY, DISSOLVED	UG/L	< 10		< 10	< 10	< 10	10
ARSENIC, DISSOLVED	UG/L	< 3		< 3	7.8	< 3	< 3
BARIUM, DISSOLVED	UG/L	< 50		< 50	< 50	140	< 50
CADMIUM, DISSOLVED	UG/L	0.66		0.98	0.35	< 0.3	< 0.3
CHLORIDE	MG/L	4.8		20	60	160	< 33
CHLOROFORM	UG/L	0.4		< 10	< 10	< 10	10
CHROMIUM, DISSOLVED	UG/L	< 2		< 2	< 2	< 2	< 2
COBALT, DISSOLVED	UG/L	< 50		< 50	< 50	< 50	< 50
COPPER, DISSOLVED	UG/L	7.7		< 3	< 3	5.6	< 3
FLUORIDE	MG/L	< 0.1		0.47	0.66	2.9	< 0.6
IRON, DISSOLVED	UG/L	< 100		19000	35000	2300	17000
LEAD, DISSOLVED	UG/L	< 3		< 3	< 3	< 3	3
MANGANESE, DISSOLVED	UG/L	510		8300	10000	69	< 5500
MERCURY, DISSOLVED	UG/L	< 0.2		< 0.2	< 0.2	< 0.2	0.2
NICKEL, DISSOLVED	UG/L	< 40		< 40	< 40	< 40	< 40
NITROGEN, NITRATE	MG/L	1.2		< 0.05	< 0.05	0.55	< 0.05
PHENOLICS, TOTAL RECOVERABLE	MG/L	0.011		0.011	< 0.01	0.015	< 0.012
SELENIUM, DISSOLVED	UG/L	< 6		< 6	< 6	< 6	6
SILVER, DISSOLVED	UG/L	< 1		< 1	< 1	< 1	< 1
SODIUM, DISSOLVED	UG/L	5800		110000	120000	340000	< 41000
SULFATE	MG/L	42		750	1200	470	400
SULFIDE	MG/L	1.3		< 1	4	1.3	1
TIN, DISSOLVED	UG/L	< 500		< 500	< 500	< 500	< 500
TOTAL ORGANIC CARBON AS NPOC	MG/L	26		7.8	7.4	43	< 23
TOTAL ORGANIC HALIDES	UG/L	< 5		5.8	13	59	17
ZINC, DISSOLVED	UG/L	45		21	22	< 20	21

4THQTR.wk3; date 26-Oct-94

ANALYTICAL LABORATORY RESULTS
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES

Parameters	Units		MW-22P 14-Sep-94		MW-23 14-Sep-94
ALKALINITY, CARBONATE	MG/L		770		34
ANTIMONY, DISSOLVED	UG/L	<	10	<	10
ARSENIC, DISSOLVED	UG/L	<	3	<	3
BARIUM, DISSOLVED	UG/L		140	<	50
CADMIUM, DISSOLVED	UG/L	<	0.3	<	0.3
CHLORIDE	MG/L		63		240
CHLOROFORM	UG/L	<	10	<	10
CHROMIUM, DISSOLVED	UG/L	<	2	<	2
COBALT, DISSOLVED	UG/L	<	50	<	50
COPPER, DISSOLVED	UG/L	<	3	<	3
FLUORIDE	MG/L		9.5		0.11
IRON, DISSOLVED	UG/L		190		30000
LEAD, DISSOLVED	UG/L	<	6	<	3
MANGANESE, DISSOLVED	UG/L		22		3700
MERCURY, DISSOLVED	UG/L	<	0.2	<	0.2
NICKEL, DISSOLVED	UG/L	<	40	<	40
NITROGEN, NITRATE	MG/L	<	0.05	<	0.05
PHENOLICS, TOTAL RECOVERABLE	MG/L	<	0.01	<	0.01
SELENIUM, DISSOLVED	UG/L	<	6	<	6
SILVER, DISSOLVED	UG/L	<	1	<	1
SODIUM, DISSOLVED	UG/L		500000		8800
SULFATE	MG/L		300		170
SULFIDE	MG/L	<	1	<	1
TIN, DISSOLVED	UG/L	<	500	<	500
TOTAL ORGANIC CARBON AS NPOC	MG/L		26		1.2
TOTAL ORGANIC HALIDES	UG/L		7.4		11
ZINC, DISSOLVED	UG/L		35		59

4THQTR.wk3; date 26-Oct-94

APPENDIX F

GROUNDWATER SAMPLING AND ANALYSIS PLAN

GROUNDWATER SAMPLING AND ANALYSIS PLAN

SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

REVISED DECEMBER 1994

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Section 1
INTRODUCTION

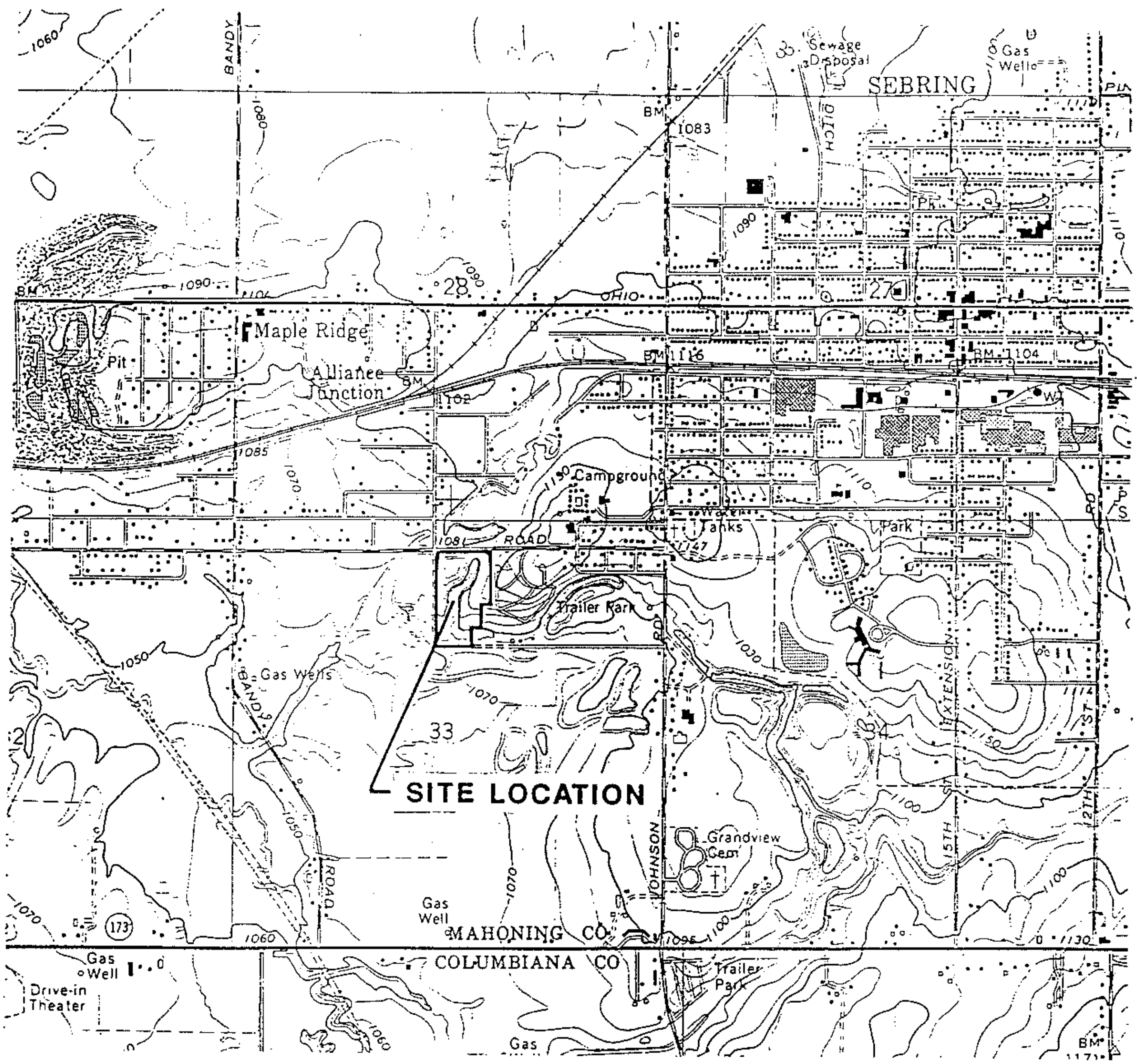
1.1 Background

The landfill, shown on Figure 1-1, has been in operation for over 20 years as a disposal site for typical foundry wastes from the Sebring facility, including foundry sand, refractories, slag material, and sludge from the sand washers and wet dust collectors.

The possibility exists that, during the past 20 years, hazardous electric arc furnace baghouse dust was intermixed with typical foundry waste and deposited in the landfill. To assess the possibility that hazardous materials were placed in the landfill and may have impacted the groundwater quality, ASF has agreed, as part of a consent decree, to perform a groundwater quality assessment of the site under RCRA 40 CFR Part 265 Subpart F, and Ohio Administrative Code (OAC) 3745-65, et seq.

1.2 Purpose and Scope

The purpose of this plan is to describe the groundwater sampling and analysis that Amsted Industries will conduct as part of the routine groundwater quality assessment of the Sebring facility. This plan replaces the Groundwater Sampling and Analysis, Plan dated March, 1992 which described the initial one year (four quarters) of groundwater quality assessment. All sampling and analysis procedures performed will conform to procedures contained in USEPA publication "Test Methods for Evaluation of Solid Waste, SW-846."



STATE LOCATION

0 2000 4000

SCALE: 1" = 2000'

SOURCE:

BASEMAP FROM A USGS 7.5 MINUTE QUADRANGLE MAP, "ALLIANCE", OHIO DATED 1966. (PHOTO REVISED 1971 & 1978)

SITE LOCATION MAP
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

RMT INC.	DWN. BY: EAS
	DATE: DECEMBER, 1991
	PROJ.# 2169.02
	FILE #

FIGURE 1-1

This plan will be kept at the Alliance facility and includes the following:

- General Sebring facility description
- Monitoring well locations and depths
- Well installation methods and materials
- Sampling equipment and sample collection methods
- Sampling frequency and schedule
- Sample handling, preservation, shipment, and chain-of-custody procedures
- Decontamination methods
- Analytical parameters, methods, and detection limits
- QA/QC measures
- Statistical evaluation criteria

Section 2

GENERAL FACILITY INFORMATION

2.1 Facility Name, Location, Contact, and Standard Industrial Code

Name: Amsted Industries, Inc. d.b.a.
American Steel Foundries
Sebring Facility

Location: Lake Park Boulevard and Heacock Road
Smith Township, Mahoning County, Ohio

Contact: Mr. Terry Bradway
Safety and Environmental Manager
American Steel Foundries
1001 East Broadway
Alliance, Ohio 44601
(216) 823-6150 ext. 206

Standard
Industrial Code: 3325

2.2 Site Description

The Sebring facility comprises a total of approximately 14.7 acres. The facility is fenced; access is from Lake Park Boulevard along Heacock Road as shown on Figure 2-1, which also shows the approximate limits of waste placement. Wastes have been placed over an area of about 8 acres and range in thickness from a few feet to more than 45 feet near the southcentral part of the landfill.

Soils adjacent to the facility generally consist of lean clay and clayey sand. Shale and siltstone outcrop on the west side of the facility and underlie the facility as well. The area immediately west and south of the site is the location of the abandoned municipal landfill for the village of Sebring. The depth to the water table varies from about 6 feet at the southwest end of the site to about 50 feet on the north and east sides of the site. Groundwater flows in a westerly direction.

Section 3

GROUNDWATER MONITORING PROGRAM

3.1 Objective of the Program

The objective of the groundwater monitoring program is to routinely evaluate whether hazardous waste or hazardous waste constituents have entered the groundwater, and if so, to determine their concentration, and rate and extent of migration in the groundwater. In particular, this program is intended to assess the quality of groundwater at the water table and in the uppermost part of the bedrock aquifer in the area immediately downgradient of the landfill to determine if it has been affected by foundry waste materials disposed on-site.

3.2 Monitoring Program

The groundwater monitoring program is summarized on Table 3-1. The program was developed based on the four quarters of groundwater monitoring conducted pursuant to the Groundwater Quality Assessment Plan (RMT, 1992) and the rationale for the program is described in detail in the Groundwater Quality Assessment Report (RMT, 1994). In summary, the groundwater quality assessment consisted of sampling site monitoring wells on a quarterly basis for one year for the following constituents:

- Major constituents and constituents of concern found in ASF foundry waste stream as determined by ASF testing programs conducted for various purposes.
- Constituents previous detected in surface and groundwater at the Sebring facility.
- Typical foundry waste landfill contaminants.
- Known or suspected adjacent sources of contamination (Tecumseh Pond and Village of Sebring municipal landfill).
- Inorganic indicator parameters useful in understanding groundwater.

Table 3-1

PROPOSED GROUNDWATER MONITORING PROGRAM
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Monitoring Wells	
Upgradient	**Downgradient**
MW-1A	MW-4A
MW-14	MW-12P*
MW-19	MW-13
MW-19P	MW-13P*
MW-23 (sidegradient)	MW-21
	MW-21P
	MW-22
	MW-22P
	MW-24*
	MW-25*

Parameters to be Analyzed	
Semiannually	**Annually**
Specific Conductance**	Chromium
pH**	Lead
Temperature**	Mercury
Manganese	Selenium
Arsenic	Silver
Cadmium	
Cobalt	
Zinc	
Nickel	
Phenols	
Iron	
Fluoride	
Barium	

* Proposed Monitoring Well

** Specific conductance, temperature, and pH will be measured in the field. Water levels will also be measured at each well in the program on a semiannual basis.

Provisions were made in the Groundwater Quality Assessment Plan to reduce the parameter list if certain parameters were not detected above the Practical Quantitation Limit (PQL) during the first quarter of monitoring. The parameter list was reduced subsequent to the first quarter. In addition, based on the entire four quarters of monitoring, the parameter list was modified further and the analysis frequency was modified (changed from quarterly to semiannual with annual analysis for some parameters). The parameter list was reduced to constituents of concern (metals) and field indicator parameters, (pH, specific conductance, and temperature).

Groundwater levels will be monitored on a semiannual basis. At the same time that water levels are measured the well will be inspected to confirm that well integrity is acceptable.

A statistical and qualitative evaluation of groundwater quality will be performed on a semiannual basis and a report submitted to the Ohio EPA. The statistical procedure is described in Section 3.5. Groundwater elevation data and analytical data will be appended to the report.

3.3 Monitoring Well Locations and Installation

In July 1985, four groundwater monitoring wells and one boring were installed near the landfill under the direction of Bowser-Morner, Inc., Dayton, Ohio. In August 1991, an additional four borings and five monitoring wells were installed under the direction of RMT, Inc., to further define the on-site geology and groundwater flow. Six borings were installed in May 1991 to obtain geologic information. Monitoring wells MW-19, MW-19P, MW-20, MW-21, MW-21P, MW-22 and MW-22P were installed under the supervision of RMT in November 1993. The locations of all the monitoring wells are shown on Figure 2-1. These wells are all constructed with PVC.

The monitoring well network is designed to evaluate, on a routine basis, whether chemical constituents of concern have migrated from the landfill into the groundwater and to determine the concentration of chemicals and rate and extent of migration. Table 3-2 summarizes the function of each well in the proposed monitoring system. Five wells will be used for determining background water quality, upgradient or sidegradient of the landfill, and ten wells will be used to indicate water quality downgradient of the landfill. Proposed well locations are also shown on Figure 2-1 and groundwater flow direction is Shown on Figure 3-1.

Proposed well depths range from approximately 35 to 60 feet below ground surface. Each well will be constructed such that the screen is in the shale (uppermost aquifer). Some of the existing wells will be used to monitor water levels only as noted in Table 3-2, which summarizes the function of each existing and proposed well in the monitoring system.

Table 3-2

MONITORING WELL SYSTEM
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

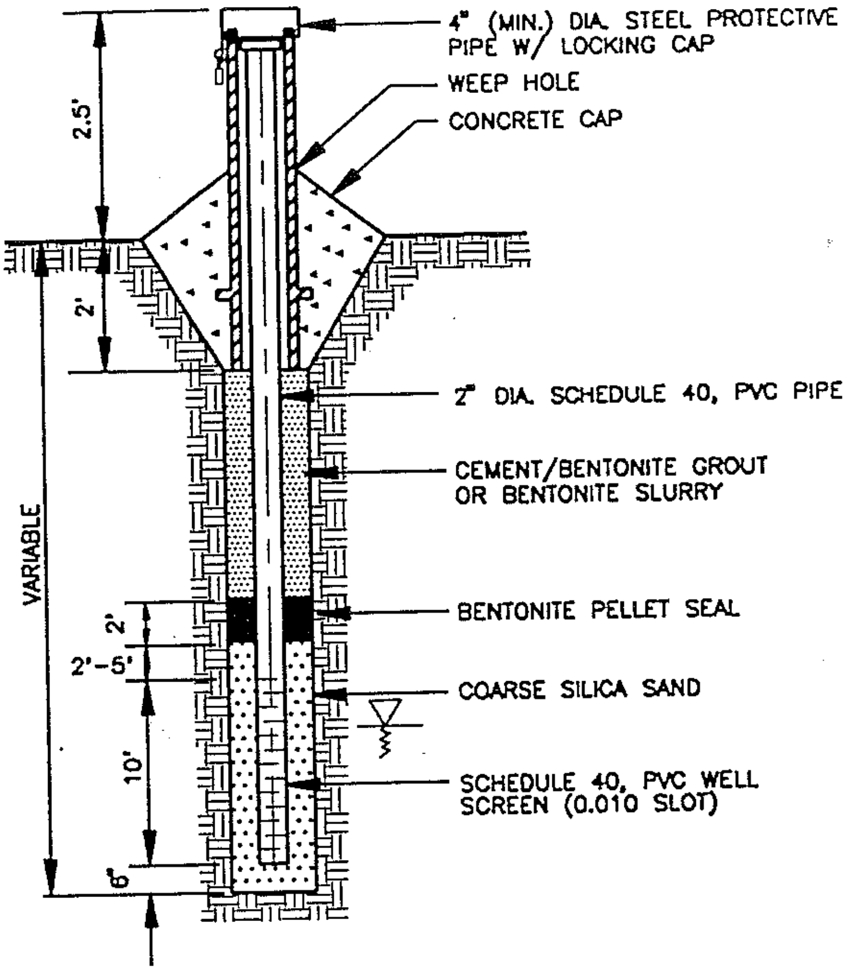
Well Designation (Existing and Proposed)	Up Gradient	Down Gradient	Water Quality	Water Level	Screen Length 5 feet	Screen Length 10 feet	Depth in feet (approximately)	Geologic Material
MW-1	x			x	x		55	Shale
MW-1A	x		x			x	42	Shale
MW-2		x		x	x		35	Shale
MW-3		x		x	x		26	Spoils
MW-4		x		x	x		32	Spoils
MW-4A		x	x	x		x	15	Spoils
MW-12		x		x		x	36	Sand & Spoils
MW-12P		x	x	x	x		50*	Shale
MW-13		x	x	x		x	38	Spoils
MW-13P		x	x	x	x		60*	Shale
MW-14	x		x	x		x	62	Shale
MW-19	x		x	x		x	55	Bedrock
MW-19P	x		x	x	x		105	Bedrock
MW-20		x	x	x		x	30	Bedrock
MW-21		x	x	x		x	30	Spoils
MW-21P		x	x	x	x		65	Bedrock
MW-22		x	x	x		x	20	Spoils
MW-22P		x	x	x	x		35	Spoils
MW-23	Side		x	x		x	35	Spoils
MW-24		x	x	x	x		35*	Shale
MW-25		x	x	x	x		55*	Shale

NOTES:
* The well screen will be placed in the permeable zone or layer encountered within the shalely bedrock formation at these approximated depths.

The proposed wells will be constructed with 2-inch diameter, Schedule 80, PVC risers and 5-foot-long screens. The casing and screens will be joined with threaded flush joints. All pipe and screens will be factory-cleaned, and delivered individually wrapped, to the site.

The borings for the wells will be drilled using hollow-stemmed augers and clear water rotary drilling techniques to the approximate depths listed in Table 3-2. Proposed well construction details are shown on Figure 3-2 and 3-3. Wells MW-24 and MW-25 will be constructed as shown on Figure 3-2. Wells MW-12P and MW-13P will be constructed as shown on Figure 3-3. Sand (washed silica or equivalent) will be backfilled around the screen and extended approximately 2 feet above the top of the well screen. A bentonite pellet seal will be installed directly above the sand layer. The remaining borehole annulus will be filled with cement/bentonite grout. A sloping concrete pad will be installed to anchor the protective casing and to direct surface run-off away from the well. Four-inch (minimum diameter) steel protective casings equipped with locks will be installed at each well. A 2-foot length of the casing will be below ground, and about 2.5 feet will be above ground.

The borehole for the monitoring wells will be sampled at 2.5-foot intervals using split-barrel sampling procedures in soil and soft bedrock, and continuous rock coring (NX or larger) in the competent bedrock. A geologist or hydrogeologist will be on-site to log and describe the samples according to the Unified Soil Classification System. The installation methods and materials will be reported on a well diagram. A sample well construction diagram is included in Appendix A.



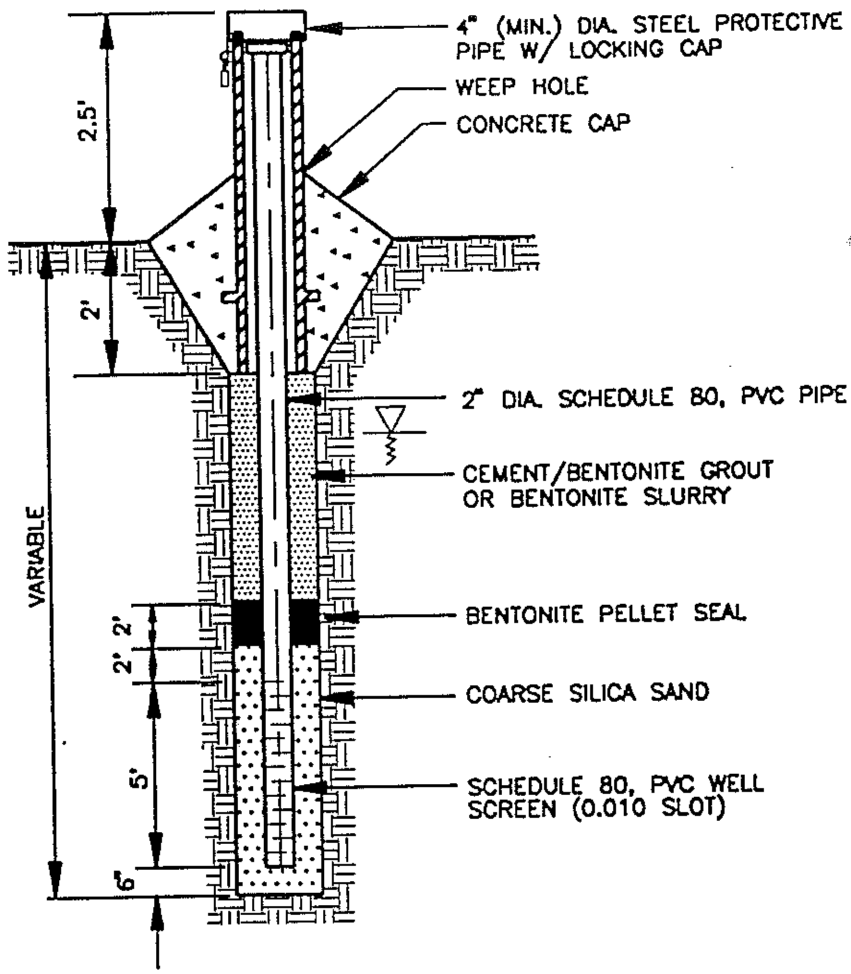
SHALLOW (WATER TABLE) WELL DETAIL

(NOT TO SCALE)

SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

RMT INC.	
	DWN. BY: EAS
	DATE: DECEMBER, 1991
	PROJ.# 2169.02
	FILE # 21690206

FIGURE 3-2



DEEP WELL DETAIL

(NOT TO SCALE)

SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

RMT INC.	
	DWN. BY: EAS
	DATE: DECEMBER, 1991
	PROJ.# 2169.02
	FILE # 21690207

FIGURE 3-3

The following cleaning procedures will be used prior to starting and between wells:

- Augers, drill rods, and other tools and drilling equipment will be cleaned using a steam-cleaner prior to use at each boring location. Water from a city potable water supply system will be used for steam-cleaning and for all drilling procedures.

- While on-site, the augers or other down-hole equipment will not be allowed to come into contact with surrounding soils prior to use.

- Decontamination will be conducted in a central location in the landfill and decontamination water will be contained in the landfill and allowed to infiltrate.

- The soil cuttings will be collected and placed in the landfill.

The wells will be developed by surging and bailing with a PVC hand bailer until pH and conductivity stabilize within ± 0.1 pH units and ±100 μmhos/cm. Development will be documented on the well construction diagrams (Appendix A).

The locations of the wells will be surveyed to an accuracy of 0.01 feet for top of casing elevations and 0.1 feet for horizontal locations. Locations will be referenced to the on-site coordinate system.

After development, in-field hydraulic conductivity tests (baildown tests) will be conducted on all new wells. Hydraulic conductivity values will be calculated using the Bouwer and Rice (1976) or Cooper, et al. (1967), technique, as appropriate.

3.4 Groundwater Monitoring Parameters

The groundwater samples will be sent to a qualified analytical laboratory. The parameters, analytical methods, and Practical Quantitation Limits are presented in Table 3-3. The groundwater level at each monitoring well will be measured prior to well purging each time a sample is obtained. Groundwater sampling and analysis procedures are described in Section 4.

Table 3-3
PARAMETERS, METHODS OF ANALYSIS AND PRACTICAL QUANTITATION LIMITS

SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Parameters	SW-846 Analytical Method	Practical Quantitation Limits
pH	9040/9041	0.1 pH unit
Iron-ICP	6010	0.10 mg/L
Fluoride	EPA 340.2	0.1 mg/L
Manganese- ICP	6010	0.005 mg/L
Phenols (colorimetric)	9066	0.01 mg/L
Specific Conductance	9050	10 μmhos/cm
Arsenic	7060	3
Barium	6010	50
Cadmium	7131	0.3
Chromium (total)	7191	2
Cobalt	6010	50
Lead	7421	3
Mercury	7470/7471	0.2
Nickel	6010	40
Selenium	7740	3
Silver	7761	1
Zinc	6010	20

NOTES:
Practical Quantitation Limits are for RMT Laboratories.
ICP-Inductively Coupled Plasma Emission Spectrophotometry.

3.5 Statistical Data Analysis and Reporting

A tolerance interval approach was used to compare 1994 background monitoring well data to 1994 downgradient monitoring well data. The following paragraphs describe the tolerance interval method. An alternate statistical method may be used to evaluate data collected in the future. If an alternate method is contemplated, the OEPA will be notified prior to conducting the analysis.

A tolerance interval is constructed from the data collected from unaffected upgradient background wells. The tolerance interval is constructed by first calculating the mean upgradient concentration of each parameter using all available upgradient data points. Then an interval above and below the mean is created based on the variability of the background data. A more detailed description of the statistical procedure and calculations is presented in Appendix E.

In the case of several parameters, the measured parameter concentration may be below the detection limit. For parameters where the percentage of non-detects is between 0% and 50%, the tolerance interval approach will be used and the detection limit will be substituted for non-detect values.

In the case of all parameters except pH, an upper tolerance interval will be calculated and compared to the actual value for a specific downgradient well. For pH, and upper and lower tolerance interval will be calculated.

For parameters where the percentage of the non-detects exceeds 50%, the tolerance interval approach is not appropriate and a test of proportions will be used. The test of proportions is a method to determine whether a difference in the proportion of detected values in the background well data compared to the downgradient well data provides statistically significant evidence of impact.

Each of the statistical methods used here is described in the U.S. EPA Publication " Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (U.S. EPA, 1989).

The results of these comparisons will provide specific information regarding hazardous wastes and/or hazardous waste constituents, if any, that may have been released from the landfill and entered the groundwater.

3.6 Schedule

Sampling will be carried out on a semiannual basis. A report containing the sample results and an evaluation of those results will be submitted to the USEPA and OEPA within 30 days of the receipt of the analytical data for each sampling round. In addition, a potentiometric map will be included detailing the position of the waste management unit in relation to the monitoring wells, ground water surface elevation contours and ground water flow direction. Based on review of the water quality results and the potentiometric map, compliance with up and downgradient monitoring well requirements will also be evaluated.

In the event that the sampling and analysis reveals that hazardous waste or hazardous constituents have entered the groundwater, the USEPA and Ohio EPA will be notified in writing within 10 days. Groundwater monitoring will continue to be conducted in accordance with the requirements of 40 CFR §265.93(d)(7), OAC 3745-65-93(d)(7), and the Groundwater Quality Assessment Report.

In addition to the above reporting of analytical data, the Supplementary Annual Groundwater Report will be completed and submitted by the required report date.

Section 4

GROUNDWATER SAMPLING AND ANALYSIS

4.1 Field Procedures

4.1.1 Measuring Static Water Level

Static water levels will be measured in each well prior to purging or sampling. All groundwater level measurements will be made using a surveyed reference point established on the well casing. The reference point will be the highest point of the PVC well casing.

A battery-operated water level indicator will be the primary device for water level measurements. The indicator is a self-contained transistorized instrument equipped with a cable and sensor which activates a buzzer and a light when it comes in contact with the water. The depth to water is read from permanent increment markings on the cable.

In case of instrument failure, depth to groundwater will be measured by a plopper tape which is a bell- or cup-shaped weight attached to a measuring tape. When lowered into the well, a "plopping" sound is made when the weight strikes the surface of the water. An accurate reading can be determined by lifting and lowering the weight in short strokes, and reading the tape when the weight just strikes the water. Depth to water will be recorded to the nearest 0.01 foot.

In order to prevent cross-contamination, the water level measuring device will be decontaminated between wells by rinsing first with a mild detergent solution such as Alconox and then with Type II reagent grade water.

4.1.2 Purging Wells

The monitoring wells will be purged to remove stagnant water to ensure that the samples collected are fresh formation water. Before purging each well, five well volumes will be calculated. The steps to calculate the purging volumes are as follows:

1. Measure depth to water and depth to the bottom of the well.
2. Subtract depth to water from the depth to bottom.
3. For a 2-inch well, multiply the result obtained in Step 2 by 0.163 gallon/foot, and multiply that by 5.

Purging wells will be accomplished by the following steps:

1. Place a plastic dropcloth around the well to minimize possible contamination of sampling equipment with soil.

2. Remove the calculated amount of water necessary to obtain a sample of fresh water from the formation. If the well bails dry, the sample will be collected as soon as there is a sufficient volume recharged to the well to fill all sample bottles.

3. Use a separate pre-cleaned bailer to remove water from each well. A Teflon®-coated, stainless-steel cable will be attached to the bailer; new polypropylene rope will also be attached to the cable.

4. Measure water removed in gallons, to ensure that sufficient volume is purged to remove stagnant water not representative of *in-situ* conditions from the well.

5. Bail in such a manner as to prevent excessive amounts of agitation.

6. Record observations of odor, color, and degree of turbidity.

7. Contain purge water and dispose of appropriately in accordance with applicable regulations. If analysis of previous groundwater samples indicates that water quality at an individual well meets applicable water quality standards, the water may be discharged to the ground.

4.1.3 Sample and Data Collection at Each Well

Samples will be collected <u>immediately</u> after purging. Some wells (e.g., well MW-19P) may recover slowly from purging. These wells will be purged several days prior to sampling. Procedures for the sampling of the monitoring wells are as follows:

1. Set up filtering equipment and prepare pH and specific conductance meters.

2. Label bottles by writing the well number, project name, date, the sampler's name, and the time of day in the sampler section.

3. Collect samples using the dedicated bailer and a bottom-emptying device to prevent excessive amounts of agitation and aeration.

4. Fill bottles for unfiltered samples first.

5. After filling bottles for unfiltered samples, collect a sample for filtering and performing field measurements.

The instruments used in the field and their calibration procedures are described below.

<u>Temperature</u> - Each field thermometer will be inspected before each field trip to see that it is not cracked and that there are no air spaces or bubbles in the mercury. Before using a thermometer in the field, field personnel will make a visual observation to ensure that it has not been damaged. The temperature of the groundwater sample will be recorded to the nearest 0.5°C immediately after the sample is removed from the well.

Specific Conductance - The specific conductance of the liquid will be measured in the same groundwater sample used for the temperature measurement. A portable specific conductance meter will be used to measure the specific conductance of the groundwater sample. Each meter will be checked before each field trip and daily while in the field. Batteries will be checked, and conductivity cells will be cleaned and checked against a known standard (0.01M KCl which reads 1413 µmhos @ 25°C).

YSI 33 S-C-T Meter - Specifications

Range: 0-500, 0-5,000, 0-50,000 µmhos/cm.

Meter Accuracy: ± 2.5% maximum error at 500, 5,000, and 50,000 plus probe error.
± 3.0% maximum error at 250, 2,500, and 25,000 plus probe error.

Probe Accuracy: ± 2% of reading

Readability: 2.5 µmhos/cm on 500 µmhos/cm range
25 µmhos/cm on 5,000 µmhos/cm range
250 µmhos/cm on 50,000 µmhos/cm range

pH - The pH measurements will be made electrometrically using a combination electrode and portable pH meter. The measurements will be recorded to the nearest 0.1 pH unit. Portable meters with provisions for temperature compensation will be used. The meter will be checked before each field trip and daily while in the field for any mechanical or electrical failures, weak batteries, and cracked or fouled electrodes. The meter and electrode also will be checked against at least two standard buffer solutions of known pH values (e.g., 4, 7, and 10). While in the field, the meter will be checked several times per day with fresh buffers. In case of an apparent discrepancy in a pH measurement, the electrode will be checked with pH 7.0 buffer and recelebrated to the closest reference buffer to the pH of the sample. The sample will then be reanalyzed. Duplicate analyses will be made until they agree within 0.1 pH unit. The buffer solution containers will be refilled each day from fresh stock solution. Decontamination of the pH probe will be done by rinsing with distilled water. A separate, clean beaker will be used at each well for conductivity and pH measurements to eliminate the possibility of cross-contamination.

Orion Research Analysis pH Meter - Specifications

pH Range: 0 to 14 with ± 0.01 pH repeatability and ± 0.05% accuracy.
mV Range: -999 to 999 mV, with ± 1.0 mV repeatability and ±5% mV accuracy.

Examples of field data sheets, meter calibration logs, and procedures to complete the field notes are given in Appendix B. A log of meter calibrations and checks will be maintained during each sampling event. The calibration and checks will be performed a minimum of four times a day following the procedures specified in the meter manuals.

4.1.4 Field Filtering

Filtering in the field will be required for all of the inorganic parameters (except sulfide) to prevent changes due to chemical precipitation or biological activity and to collect a more representative sample of the water moving through the ground. In many cases, there may be a small amount of silt or clay in the water after purging the well. This sediment is not representative of constituents transported in groundwater flow systems in porous media. The filtering is performed in the field immediately after sample collection because even short delays may significantly change the water chemistry.

An in-line filtering system, consisting of a disposable filter, bailer, and small hand pump, will be used to collect and filter the samples for inorganics analysis. The pump forces water out of the bailer and through the filter. The possibility of cross-contamination is minimized as both the bailer and filter are disposable and are not reused from one well to another.

4.1.5 Equipment Cleaning Procedures Between Sampling Events

All equipment used for sampling that is not dedicated (purging bailers, water level measuring devices, etc.) is decontaminated after the sampling event using the following methods:

1. Prepare a soapy water bath using laboratory-grade detergent.
2. The inside and outside of filtering equipment are to be washed with a fine-bristle brush.
3. Water level measuring devices are unwound and soaked in soapy water and wiped clean with a cloth.
4. All equipment is rinsed with tap water.
5. All equipment, except water level measuring devices, is rinsed inside and outside with dilute 1:1 nitric acid.
6. Rinse all equipment with Type II reagent water.
7. Dry all equipment, except water level measuring devices, in oven at 105°C, and seal in polypropylene plastic to prevent contamination.

4.1.6 Equipment Cleaning Procedures Between Monitoring Wells

The procedures to be followed for cleaning equipment in the field between wells are as follows:

1. Rinse all equipment with fresh soapy water.
2. Rinse all equipment with Type II reagent grade water.
3. Rinsate will be disposed on the ground surface near each well sampled.

4.2 Sample Preservation Methods

The preservation methods for the parameters to be analyzed are listed in Table 4-1.

4.3 Chain-Of-Custody Guidelines

A Chain-of-Custody Form is intended to be a written record of sample possession and transference and is considered to be a legal document. The guidelines for the Chain-of-Custody Form to be used by sampling and laboratory personnel to ensure proper tracking are outlined below. An example of a Chain-of-Custody Form is included in Appendix C. While filling out the Chain-of-Custody Form, it is important to use only black ink and to write legibly. Errors are to be corrected by drawing a single line through the incorrect information and entering the correct information. All corrections are to be initialed and dated by the person making the correction.

A checklist of information that must be included on the Chain-of-Custody Form (see Appendix C) is as follows:

1. ***Bottles prepared by*** - The laboratory providing the bottles must sign their name here.
2. ***Date / Time*** - To be filled out by the person preparing the bottles.
3. ***Office code*** - To be filled out by the person preparing the bottles.
4. ***Project no.*** - To be completed by the laboratory.
5. ***Client*** - To be completed by the laboratory.
6. ***Sampler*** - The person/persons collecting the samples must sign their name and print their name under their signature. The date and time the sampler relinquishes the samples to either the laboratory or shipper must also be recorded.
7. ***Laboratory no.*** - This number is a unique identification number assigned by the laboratory.
8. ***Year / Date*** - The year and date the samples are collected.

Table 4-1

SAMPLE TREATMENT
SEBRING FACILITY
AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO

Parameter	Bottle Material	Preservative	Holding Time
Appendix IX Metals			
Arsenic	Polyethylene	HNO_3	6 months
Barium	Polyethylene	HNO_3	6 months
Cadmium	Polyethylene	HNO_3	6 months
Chromium (Total)	Polyethylene	HNO_3	6 months
Cobalt	Polyethylene	HNO_3	6 months
Lead	Polyethylene	HNO_3	6 months
Mercury	Polyethylene	HNO_3	6 months
Nickel	Polyethylene	HNO_3	6 months
Selenium	Polyethylene	HNO_3	6 months
Silver	Polyethylene	HNO_3	6 months
Zinc	Polyethylene	HNO_3	6 months
Other Parameters			
Fluoride	Polyethylene	None	28 days
Iron	Polyethylene	HNO_3	6 months
Manganese	Polyethylene	HNO_3	6 months
Phenol	Glass	Sulfuric Acid	28 days
pH	Analysis Performed in Field	Analysis Performed in Field	--
Temperature	Analysis Performed in Field	Analysis Performed in Field	--
Specific Conductance	Analysis Performed in Field	Analysis Performed in Field	

NOTES: All samples are kept cool. (4°C) during transport and storage, regardless of parameter.

9. ***Time*** - The time the sample is collected. This time **MUST** also be noted on the sample bottle.

10. ***Sample station ID*** - The location the sample was collected from, e.g., Pit 1, Tank 17, etc.

11. ***Total number of containers*** - Add up all of the bottles filled, and write total here.

12. ***Sample type*** - Circle sample type listed on Chain-of-Custody Form.

13. ***Container inventory*** - To be completed by laboratory providing the bottles.

14. ***Filtered*** - Place Y (yes) or N (no) to indicate whether the sample in a particular bottle is filtered or not.

15. ***Preserved*** - To be completed by laboratory.

16. ***Refrigerated*** - To be completed by laboratory.

17. ***Comments*** - Sampler may provide additional information about a sample, e.g., if an odor is present.

18. ***Relinquished by / Received by*** - This part of the form is a record of the individuals who actually had the samples in their custody. The spaces must be used in chronological order as the Chain-of-Custody Form is transferred with the samples.

    (1) Sampler signs when relinquishing custody.
    (2) Person accepting custody of samples from sampler signs.
    (3) Person in (2) must sign when relinquishing custody.
    (4)-(6) These are completed as necessary in the same manner as above.

    Note: If commercial carriers are used, the name of the carrier, any airbill number, and date and time of relinquishing is written in by sample entry or field personnel, and the airbill is attached to the Chain-of-Custody Form.

    The final signature is that of the person receiving the samples at the laboratory.

19. ***Seal #*** - Not applicable.

20. ***Seal #*** - Not applicable.

21. ***Hazards associated with samples*** - This section is for field use. It can include any known or suspected hazard associated with the samples. Sample entry personnel may add information to this section based on project manager or supervisor communication to the laboratory after samples are received. Laboratory group supervisors will use any hazard information to update and revise their analysis before work is started.

4.4 Sample Shipment Methods

4.4.1 Time Period

At the completion of the sampling event, samples will be transported to the contracted laboratory immediately to ensure that holding times of the analyses (Table 4-1) are met.

4.4.2 Handling

1. Method of Transport - The method of transport used should be one that will ensure that the samples will be delivered to the laboratory overnight, such as Federal Express.

2. Transport Container and Packing - The samples will be transported in 48-quart coolers.

- Sample packaging procedures will include the following:
- Place several layers of cushioning (bubble pack) in the bottom of the cooler.
- Place cushioning material around all glass bottles.
- Fill a plastic garbage bag with ice, and place on top of samples. Place completed chain-of-custody in Ziploc® bag and tape to inside cover of cooler.
- Tape the drain on cooler shut, and wrap the cooler completely with tape in two locations.
- Place "This Side Up" and "Fragile" labels on cooler.

3. Labels for the transport containers will be addressed to the contracted laboratory.

4.4.3 Sample Bottle Labels

Each sample bottle will be labeled so that the analytical laboratory has the following information:

- Site identification
- Sampling date and time
- Sample identification or location
- Sampling crew
- Type of analysis to which the groundwater will be subjected

All labels are color coded to indicate the type of preservative in the bottle (e.g., Red - Nitric acid, Yellow - Sulfuric acid, Black - No preservative).

4.5 Quality Assurance and Quality Control

4.5.1 Field QA/QC Procedures

A field (equipment rinsate) blank will be collected during each sampling round and submitted to the laboratory to assess the quality of the analytical data. This sample will be taken near the monitoring well with the highest specific conductance.

The intent of the field blank is to ensure that the nondedicated filtering equipment has been effectively cleaned and will consist of Type II reagent water which has been subjected to the same field methods as the samples from the monitoring wells. The field blank will be analyzed for the same parameters as the groundwater samples. The procedures for the collection of the field blank are as follows:

1. Decontaminate the filtering equipment using the specified procedure in Subsection 4.1.6 on cleaning procedures between monitoring wells.
2. Pour a portion of deionized water into the decontaminated filtering equipment, and filter it as though it were a groundwater sample.
3. Pour the filtered sample into the appropriate bottles, and place bottles on ice.
4. Perform pH, conductivity, and temperature.

One field duplicate will be collected per sampling event and analyzed for the same parameters as the other groundwater samples.

4.5.2 Laboratory QA/QC Procedures

Samples will be analyzed by a qualified laboratory in accordance with QA/QC procedures outlined in that laboratory's quality assurance manual. The quality assurance manual is an in-house document which discusses all of the analytical procedures to be followed by the contracted laboratory in order to meet data quality objectives as well as to meet pertinent regulatory requirements. The laboratory's quality assurance manual will be provided to the agency along with the results of the first sampling event for 1995. Control samples will be analyzed as appropriate for the SW 846 analytical method.

Section 5

REFERENCES

Bouwer, H. and R.C. Rice. 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research. Vol. 12, no. 3. pp. 423-428.

Cooper, H.H., J.D. Bredehoeft, and S.S. Papadopulos. 1967. Response of a finite-diameter well to an instantaneous charge of water. Water Resources Research. Vol. 3, no. 1. pp. 263-269.

RMT, Inc. 1992. Groundwater Quality Assessment Plan For Sebring Facility, American Steel Foundries, Alliance, Ohio. January 1992.

RMT, Inc. 1994. Groundwater Quality Assessment For Sebring Facility, American Steel Foundries, Alliance, Ohio. November 1994.

APPENDIX A
MONITORING WELL CONSTRUCTION DIAGRAM

7.

PROJECT NAME: ____________ NO. ________

WELL NO. ____________

DATE INSTALLED ____________

ELEV. (T.O.C.) ________

GROUND SURF. ELEV. ________

____

BENTONITE PELLETS/GRANULAR/POWDER ________

BACKFILL MATERIAL ________

____

BACKFILL METHOD

PIPE TREMIE/HOSE TREMIE GRAVITY FILLED ________

BENTONITE PELLETS/GRANULAR/POWDER ________

SILICA SAND ________

FILTER PACK MATERIAL ________

WELL BOTTOM ELEV. ________

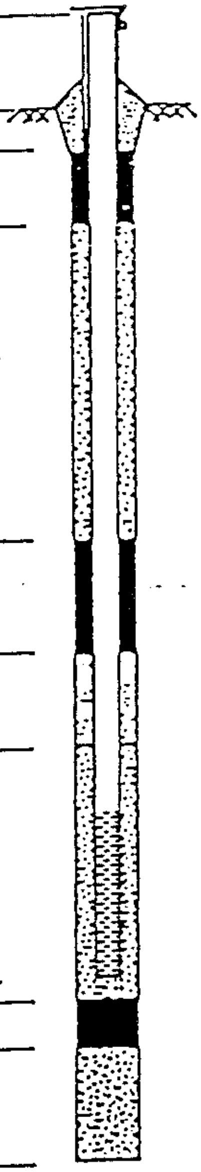
SEAL MATERIAL ________

BACKFILL MATERIAL ________

LENGTH OF SOLID PIPE

FT.

WELL SCREEN LENGTH



DEPTH FROM GROUND SURFACE

____ FT.

____ FT.

BOREHOLE DIA.

____ IN.

____ FT.

____ FT.

____ FT.

____ FT.

____ FT.

____ FT.

____ FT.

____ FT.

1) CASING DETAILS

A) TYPE OF PIPE:

PVC, STAINLESS, TEFLON, OTHER ________

PIPE SCHEDULE ________

B) TYPE OF PIPE JOINTS:

COUPLINGS, THREADED (W/TAPE), OTHER ________

C) WAS SOLVENT USED? YES OR NO

D) TYPE OF WELL SCREEN:

PVC, STAINLESS, TEFLON, OTHER ________

E) WELL SCREEN SLOT SIZE ________

F) PIPE DIA: ID IN. ____ OD IN. ____

G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO

PROTECTOR PIPE DIA. ____ IN.

2) WELL DEVELOPMENT

A) METHOD

BAILING, PUMPING, SURGING, COMPRESSED AIR

OTHER ________

(NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? ________

C) APPROXIMATE WATER VOLUME: REMOVED ________

ADDED ________

D) WATER CLARITY BEFORE DEVELOPMENT?

CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?

CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?

____ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):

DATE/TIME ________ FT.

DATE/TIME ________ FT.

DATE/TIME ________ FT.

ADDITIONAL COMMENTS: ________

APPENDIX B
GUIDELINES FOR FIELD NOTES

APPENDIX B

GUIDELINES FOR FIELD NOTES

The importance of recording accurate, complete, and informative field notes cannot be overstated. The quality of the field persons' work is reflected directly in their field record. The field notes are the only reliable record of information gathered in the field. Information gathered in the field should be recorded in the field on standard field book note paper. Notes should be permanent, legible, complete, and capable of only one interpretation. Notes should be recorded with an All-Weather pen with black ink. Field book paper which is resistant to water and that can be marked when wet is available and should be used.

Field notes are to be recorded immediately in the field. Records made on scratch paper and copied later, or other information recorded from memory, are not considered field notes. If these are entered as field notes at some time other than when actual field records are made, then doubt is cast on all of the data.

The two foremost goals of good field notes are as follows:

1. To provide adequate and complete information that is useful and understandable to someone other than the note-taker.

2. To provide documentation of work done or data gathered that is of a quality to withstand the test of legal testimony in a court of law.

Note-takers should always keep the goal of the field assignment and the intended use of the notes foremost in their mind. The notes should be complete and understandable enough so that someone not associated with the actual field job can use them for the intended purpose without the need to question the note-taker or other members of the field crew about the correct interpretation of the notes. There should also be an awareness of what the notes or information might possibly be used for besides the primary purpose of the field investigations. Field staff should make a point of questioning the project manager or technical coordinator if they are unclear on this issue.

If field notes are to be useful, they must be legible. For this reason, they should be lettered instead of written. The lettering should be of a size which is easily readable yet which allows a reasonable amount of data to be entered on the page without crowding. Explanatory remarks are always necessary to clarify the field procedures and provide all of the details.

Field sketches are also very useful and should be used freely. Erasures should not be used, as they always cast doubt on the reliability of the records. If a correction needs to be made to the notes, draw a SINGLE line through the mistake, and date and initial it. All additions, revisions, reductions, or comments added to field notes in the office should be done in ink (usually red) to indicate that such information is not part of the original field record.

A checklist of information that must be included in the field notes for sampling is as follows:

1. Client - Generally this is the project name. Do not use abbreviations.

2. Job number - Be sure this is the correct number. It should be obtained from the trip coordinator or the project manager.

3. Sample no. and type - Name of sample location, e.g., MW-1/water, Production Well-2/water, sludge basin/waste, Johnson/Private well, etc.

4. Date - Date work was performed.

5. Name(s) of sampler - Do not use initials.

6. Well Diameter - Inside diameter of well.

7. Time - Time work at sample location was started. State A.M. or P.M.

8. Depth to water and ref. point - This measurement should always be taken from the top of the well, not from the protective casing. Measurements recorded should be as follows: 10.21 feet + 0.00 feet T/PVC if an electric water level indicator is used, and 10.21 feet + 0.17 feet T/PVC if a plopper tape is used. Lengths of ploppers vary, so you must measure it before each field trip. If the well is PVC and the pipe is cut on a slant, the measurement should be taken from the highest point.

9. Depth to bottom of well - This measurement should be taken in the same manner as depth to water. A nylon-coated steel tape with plopper will be used to measure depth to bottom. The lead and plopper length must be added to all depth to bottom measurements.

10. Water elevation - The depth to water and plopper length should be added together, and the calculated water elevation should be written here in red. This should be done when summarizing notes after the field trip.

11. Total Volume removed - Record the actual amount of water purged from the well in gallons. A pail calibrated in gallons and quarts will be used. Please note: This is the ACTUAL volume removed not the calculated volume.

12. Method - Note the device used to purge, i.e., bailer, submersible pump. If a well goes dry, it should be noted as follows: Bailed dry at 3.5 gal.

13. Color - Note actual color of purged water.

14. Turbidity - Comment on degree of turbidity and report as slight, moderate, or very.

15. Comments - Use this space to record such things as sheens on water, unusual amounts of sediment present, and/or other out-of-the-ordinary observations.

16. Date - The date recorded should be the date the sample was collected. Since it is our policy to sample immediately after purging, this date will be the same as the purging date. The exception would be extremely slow recovering wells that might take longer than 24 hours.

17. Time - Time sample collection started. Please note A.M. or P.M. Please note that the sample must be collected immediately after purging unless the well goes dry.

18. Color - Use same procedure as in Step 13.

19. Turbidity - Use same procedure as in Step 14.

20. Comments - Use same procedure as in Step 15.

21. pH - This measurement must be performed immediately after sample is collected. pH should be recorded to nearest 0.1 pH unit. Four readings should be taken as follows:

    a) Place electrode in sample.
    b) Let meter stabilize and take reading.
    c) Shut meter off, and remove electrode from sample.
    d) Rinse electrode.
    e) Repeat A through D until 4 readings have been recorded.

22. Specific conductance - This measurement must also be performed immediately after sample is collected but before pH. Meter should be read to the nearest 5 μmhos. Four readings should be obtained using the same procedures as noted for pH in Step 21.

23. Temperature - Temperature of the sample must also be taken immediately after the sample is collected and should be recorded to the nearest 0.5°. A Celsius thermometer should be used.

24. Average - These numbers are calculated after the fieldwork has been completed and should be written in red. pH is the average of four readings, and specific conductance is also the average of four readings, converted to 25°C and reported to the nearest 10 μmhos.

25. Time - The time the filtration procedure is started should be recorded here. Note A.M. or P.M.

26. Color - Same procedure as in Step 13.

27. Turbidity - Same procedure as in Step 14.

28. Comments - Notes relating to filtration difficulty. If a sample takes an unusually long time to filter, the length of time should be noted here. Also, any observations made, other than odor, color, and turbidity, should be noted here.

29. Bottles Filled - This section is intended to serve as an inventory of the bottles filled. It should be filled out completely and accurately after the bottles have been filled and before being placed in cooler. Abbreviations should not be used.

30. Chain-of-custody number - This number is found in the upper right-hand corner of the chain-of-custody form.

31. Date shipped - Record the date the samples are shipped to the laboratory. If they are not shipped, record the date on which they are given to the laboratory.

32. Method - Record the name of the shipping used e.g., Fed Ex., Airborne. If the samples are not shipped and you transport them via vehicle, please note this.

33. Airbill number - Record the airbill number found on the shipping form. If the samples are not shipped, place a line here.

34. Signed - The signature should be of the sampler or the field QA/QC design.

35. Date - The date the log is signed should be recorded here.

36. QC'd by - The signature of the sampling QC/QA officer should be recorded here.

37. Date - The date on which the sampling QA/QC officer signs the logs should be recorded here.

38. Page - When all of the field notes are assembled, number the pages.

A title page for all field jobs should be attached to the field notes. It should consist of the project name and number, the location of the project, the dates on which the fieldwork was performed, the purpose of the fieldwork, name of person performing the fieldwork, and a short description of the weather conditions.

In summary, the field notes should

- show all data with sufficient explanation to prevent misinterpretation and with answers to all questions;
- be relative to the immediate purpose of the field assignment and should also anticipate reasonable future uses of the notes;
- be legible; and
- be recorded as if the eventual user of the notes was not present when the fieldwork was performed.

The original field notes often afford the only possible means of accomplishing the desired ends, and, unless sufficiently complete, they may be worthless. These same guidelines apply to notes taken during other field activities.

APPENDIX C

SAMPLE CHAIN-OF-CUSTODY FORM

LABORATORIES
F-268 (R2/86)
(Use Black Ink Only)

Phone (608) 831-4444
FAX (608) 831-7530

CHAIN OF CUSTODY RECORD

Sample Type: (GW, WW, SW, Soil, Other)

№ 02,838

Bottles Prepared by:	Date/Time	Office Code: (State)

Project No.	Client:

Container Inventory: Filtered (Yes/No) / Preserved (Code) / Refrigerated (Yes/No)

Code: A - None
B - HNO_3
C - H_2SO_4
D - NaOH
E - ______

RMT Lab NO.	Yr. ___ Date	Time	Sample Station ID	Total Number Of Containers									Comments:

SAMPLER Relinquished by (Sig.) ①	Date/Time	Received by (Sig.) ② Shipper Name & #	Date/Time
Relinquished by (Sig.) ③	Date/Time	Received by (Sig.) ④ Shipper Name & #	Date/Time
Relinquished by (Sig.) ⑤	Date/Time	Received by (Sig.) ⑥ Shipper Name & #	Date/Time

Seal #   at'chd by ◯   Recvd. Intact by ◯   Seal #   at'chd by ◯   Recvd. Intact by ◯

HAZARDS ASSOCIATED WITH SAMPLES

(For Lab Use Only)

Receipt Temp ______ Receipt pH ______

Client P.O. Number ______

Subsequent Analysis: ______ (Check)

Date Resubmitted ______

APPENDIX D

STATISTICAL EVALUATION METHODS

EPA/530-SW-89-026

PB89-151047

STATISTICAL ANALYSIS OF GROUND-WATER MONITORING DATA AT RCRA FACILITIES

INTERIM FINAL GUIDANCE

OFFICE OF SOLID WASTE
WASTE MANAGEMENT DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY
401 M STREET, S.W.
WASHINGTON, D.C. 20460

FEBRUARY 1989

For data sets with more than 30 observations, the parametric analysis of variance performed on the rank values is a good approximation to the Kruskal-Wallis test (Quade, 1966). If the user has access to SAS, the PROC RANK procedure is used to obtain the ranks of the data. The analysis of variance procedure detailed in Section 5.2.1 is then performed on the ranks. Contrasts are tested as in the parametric analysis of variance.

INTERPRETATION

The Kruskal-Wallis test statistic is compared to the tabulated critical value from the chi-squared distribution. If the test statistic does not exceed the tabulated value, there is no statistically significant evidence of contamination and the analysis would stop and report this finding. If the test statistic exceeds the tabulated value, there is significant evidence that the hypothesis of no differences in compliance concentrations from the background level is not true. Consequently, if the test statistic exceeds the critical value, one concludes that there is significant evidence of contamination. One then proceeds to investigate where the differences lie, that is, which wells are indicating contamination.

The multiple comparisons procedure described in steps 5 and 6 compares each compliance well to the background well. This determines which compliance wells show statistically significant evidence of contamination at an experimentwise error rate of 5 percent. In many cases, inspection of the mean or median concentrations will be sufficient to indicate where the problem lies.

5.3 TOLERANCE INTERVALS BASED ON THE NORMAL DISTRIBUTION

An alternate approach to analysis of variance to determine whether there is statistically significant evidence of contamination is to use tolerance intervals. A tolerance interval is constructed from the data on (uncontaminated) background wells. The concentrations from compliance wells are then compared with the tolerance interval. With the exception of pH, if the compliance concentrations do not fall in the tolerance interval, this provides statistically significant evidence of contamination.

Tolerance intervals are most appropriate for use at facilities that do not exhibit high degrees of spatial variation between background wells and compliance wells. Facilities that overlie extensive, homogeneous geologic deposits (for example, thick, homogeneous, lacustrine clays) that do not naturally display hydrogeochemical variations may be suitable for this statistical method of analysis.

A tolerance interval establishes a concentration range that is constructed to contain a specified proportion (P%) of the population with a specified confidence coefficient, Y. The proportion of the population included, P, is referred to as the coverage. The probability with which the tolerance interval includes the proportion P% of the population is referred to as the tolerance coefficient.

A coverage of 95% is recommended. If this is used, random observations from the same distribution as the background well data would exceed the upper tolerance limit less than 5% of the time. Similarly, a tolerance coefficient of 95% is recommended. This means that one has a confidence level of 95% that the upper 95% tolerance limit will contain at least 95% of the distribution of observations from background well data. These values were chosen to be consistent with the performance standards described in Section 2. The use of these values corresponds to the selection of α of 5% in the multiple well testing situation.

The procedure can be applied with as few as three observations from the background distribution. However, doing so would result in a large upper tolerance limit. A sample size of eight or more results is an adequate tolerance interval. The minimum sampling schedule called for in the regulations would result in at least four observations from each background well. Only if a single background well is sampled at a single point in time is the sample size so small as to make use of the procedure questionable.

Tolerance intervals can be constructed assuming that the data or the transformed data are normally distributed. Tolerance intervals can also be constructed assuming other distributions. It is also possible to construct nonparametric tolerance intervals using only the assumption that the data came from some continuous population. However, the nonparametric tolerance intervals require such a large number of observations to provide a reasonable coverage and tolerance coefficient that they are impractical in this application.

The range of the concentration data in the background well samples should be considered in determining whether the tolerance interval approach should be used, and if so, what distribution is appropriate. The background well concentration data should be inspected for outliers and tests of normality applied before selecting the tolerance interval approach. Tests of normality were presented in Section 4.2. Note that in this case, the test of normality would be applied to the background well data that are used to construct the tolerance interval. These data should all be from the same normal distribution.

In this application, unless pH is being monitored, a one-sided tolerance interval or an upper tolerance limit is desired, since contamination is indicated by large concentrations of the hazardous constituents monitored. Thus, for concentrations, the appropriate tolerance interval is (0, TL), with the comparison of importance being the larger limit, TL.

PURPOSE

The purpose of the tolerance interval approach is to define a concentration range from background well data, within which a large proportion of the monitoring observations should fall with high probability. Once this is done, data from compliance wells can be checked for evidence of contamination by simply determining whether they fall in the tolerance interval. If they do not, this is evidence of contamination.

In this case the data are assumed to be approximately normally distributed. Section 4.2 provided methods to check for normality. If the data are n(normal, take the natural logarithm of the data and see if the transformed data are approximately normal. If so, this method can be used on the logarithms of the data. Otherwise, seek the assistance of a professional statistician.

PROCEDURE

Step 1. Calculate the mean, $\bar{X}$, and the standard deviation, S, from the background well data.

Step 2. Construct the one-sided upper tolerance limit as

$$TL = \bar{X} + K\ S,$$

where K is the one-sided normal tolerance factor found in Table 5, Appendix B.

Step 3. Compare each observation from compliance wells to the tolerance limit found in Step 2. If any observation exceeds the tolerance limit, that is statistically significant evidence that the well is contaminated. Note that if the tolerance interval was constructed on the logarithms of the original background observations, the logarithms of the compliance well observations should be compared to the tolerance limit. Alternatively the tolerance limit may be transferred to the original data scale by taking the antilogarithm.

REFERENCE

Lieberman, Gerald J. 1958. "Tables for One-sided Statistical Tolerance Limits." *Industrial Quality Control*. Vol. XIV, No. 10.

EXAMPLE

Table 5-5 contains example data that represent lead concentration levels in parts per million in water samples at a hypothetical facility. The background well data are in columns 1 and 2, while the other four columns represent compliance well data.

Step 1. The mean and standard deviation of the n = 8 observations have been calculated for the background well. The mean is 51.4 and the standard deviation is 16.3.

Step 2. The tolerance factor for a one-sided normal tolerance interval is found from Table 5, Appendix B as 3.188. This is for 95% coverage with probability 95% and for n = 8. The upper tolerance limit is then calculated as 51.4 + (3.188)(16.3) = 103.4.

Step 3. The tolerance limit of 103.3 is compared with the compliance well data. Any value that exceeds the tolerance limit indicates statistically significant evidence of contamination. Two observations from Well 1, two observations from Well 3, and all four observations from Well 4 exceed the tolerance limit. Thus there is statistically significant evidence of contamination at Wells 1, 3, and 4.

TABLE 5-5. EXAMPLE DATA FOR NORMAL TOLERANCE INTERVAL

Lead concentrations (ppm)

Date	Background well A	Background well B	Compliance wells Well 1	Compliance wells Well 2	Compliance wells Well 3	Compliance wells Well 4
Jan 1	58.0	46.1	273.1*	34.1	49.9	225.9*
Feb 1	54.1	76.7	170.7*	93.7	73.0	183.1*
Mar 1	30.0	32.1	32.1	70.8	244.7*	198.3*
Apr 1	46.1	68.0	53.0	83.1	202.4*	160.8*

n = 8
Mean = 51.4
SD = 16.3

The upper 95% coverage tolerance limit with tolerance coefficient of 95% is 51.4 + (3.188)(16.3) = 103.4

* Indicates contamination

INTERPRETATION

A tolerance limit with 95% coverage gives an upper bound below which 95% of the observations of the distribution should fall. The tolerance coefficient used here is 95%, implying that at least 95% of the observations should fall below the tolerance limit with probability 95%, if the compliance well data come from the same distribution as the background data. In other words, in this example, we are 95% certain that 95% of the background lead concentrations are below 104 ppm. If observations exceed the tolerance limit, this is evidence that the compliance well data are not from the same distribution, but rather are from a distribution with higher concentrations. This is interpreted as statistically significant evidence of contamination.

5.4 PREDICTION INTERVALS

A prediction interval is a statistical interval calculated to include one or more future observations from the same population with a specified confidence. This approach is algebraically equivalent to the average replicate (AR) test that is presented in the Technical Enforcement Guidance Document (TEGD), September 1986. In ground-water monitoring, a prediction interval approach may be used to make comparisons between background and compliance well data. This method of analysis is similar to that for calculating a tolerance limit, and familiarity with prediction intervals or personal preference would be the only reason for selecting them over the method for tolerance limits. The concentrations of a hazardous constituent in the background wells are used to establish an interval within which K future observations from the same population are expected to lie with a specified confidence. Then each of K future observations of compliance well concentrations is compared to the prediction interval. The interval is constructed to contain all of K future

It should be noted that the nonparametric methods presented earlier automatically deal with values below detection by regarding them as all tied at a level below any quantitated results. The nonparametric methods may be used if there is a moderate amount of data below detection. If the proportion of nonquantified values in the data exceeds 25%, these methods should be used with caution. They should probably not be used if less than half of the data consists of quantified concentrations.

8.1.1 The DL/2 Method

The amount of data that are below detection plays an important role in selecting the method to deal with the limit of detection problem. If a small proportion of the observations are not detected, these may be replaced with a small number, usually the method detection limit divided by 2 (MDL/2), and the usual analysis performed. This is the recommended method for use with the analysis of various procedure of Section 5:2.1. Seek professional help if in doubt about dealing with values below detection limit. The results of the analysis are generally not sensitive to the specific choice of the replacement number.

As a guideline, if 15% or fewer of the values are not detected, replace them with the method detection limit divided by two and proceed with the appropriate analysis using these modified values. Practical quantitation limits (PQL) for Appendix IX compounds were published by EPA in the Federal Register (Vol 52, No 131, July 9, 1987, pp 25947-25952). These give practical quantitation limits by compound and analytical method that may be used in replacing a small amount of nondetected data with the quantitation limit divided by 2. If approved by the Regional Administrator, site specific PQL's may be used in this procedure. If more than 15% of the values are reported as not detected, it is preferable to use a nonparametric method or a test of proportions.

8.1.2. Test of Proportions

If more than 50% of the data are below detection but at least 10% of the observations are quantified, a test of proportions may be used to compare the background well data with the compliance well data. Clearly, if none of the background well observations were above the detection limit, but all of the compliance well observations were above the detection limit, one would suspect contamination. In general the difference may not be as obvious. However, a higher proportion of quantitated values in compliance wells could provide evidence of contamination. The test of proportions is a method to determine whether a difference in proportion of detected values in the background well observations and compliance well observations provides statistically significant evidence of contamination.

The test of proportions should be used when the proportion of quantified values is small to moderate (i.e., between 10% and 50%). If very few quantified values are found, a method based on the Poisson distribution may be used as an alternative approach. A method based on a tolerance limit for the number of detected compounds and the maximum concentration found for any detected compound has been proposed by Gibbons (1988). This alternative would be appropriate when the number of detected compounds is quite small relative to the number of compounds analyzed for as might occur in detection monitoring.

PURPOSE

The test of proportions determines whether the proportion of compounds detected in the compliance well data differs significantly from the proportion of compounds detected in the background well data. If there is a significant difference, this is statistically significant evidence of contamination.

PROCEDURE

The procedure uses the normal distribution approximation to the binomial distribution. This assumes that the sample size is reasonably large. Generally, if the proportion of detected values is denoted by P, and the sample size is n, then the normal approximation is adequate, provided that nP and n(1-P) both are greater than or equal to 5.

Step 1. Determine X, the number of background well samples in which the compound was detected. Let n be the total number of background well samples analyzed. Compute the proportion of detects:

$$\hat{P}_u = x/n$$

Step 2. Determine Y, the number of compliance well samples in which the compound was detected. Let M be the total number of compliance well samples analyzed. Compute the proportion of detects:

$$\hat{P}_d = y/m$$

Step 3. Compute the standard error of the difference in proportions:

$$S_D = \{[(x+y)/(n+m)][1 - (x+y)/(n+m)][1/n + 1/m]\}^{1/2}$$

and form the statistic:

$$Z = (\hat{P}_u - \hat{P}_d)/S_D$$

Step 4. Compare the absolute value of Z to the 97.5th percentile from the standard normal distribution, 1.96. If the absolute value of Z exceeds 1.96, this provides statistically significant evidence at the 5% significance level that the proportion of compliance well samples where the compound was detected exceeds the proportion of background well samples where the compound was detected. This would be interpreted as evidence of contamination. (The two-sided test is used to provide information about differences in either direction.)

EXAMPLE

Table 8-2 contains data on cadmium concentrations measured in background well and compliance wells at a facility. In the table, "BDL" is used for below detection limit.

TABLE 8-2. EXAMPLE DATA FOR A TEST OF PROPORTIONS

Cadmium concentration (µg/L) at background well (24 samples)		Cadmium concentration (µg/L) at compliance wells (64 samples)		
0.1	BDL	0.12	BDL	0.024
0.12	BDL	0.08	BDL	BDL
BDL*	BDL	BDL	BDL	BDL
0.26	BDL	0.2	0.11	BDL
BDL		BDL	0.06	BDL
0.1		0.1	BDL	BDL
BDL		BDL	0.23	0.1
0.014		0.012	BDL	0.04
BDL		BDL	0.11	BDL
BDL		BDL	BDL	BDL
BDL		BDL	0.031	0.1
BDL		BDL	BDL	BDL
BDL		BDL	BDL	0.01
0.12		0.12	BDL	BDL
BDL		0.07	BDL	BDL
0.21		BDL	BDL	BDL
BDL		0.19	0.12	BDL
0.12		BDL	0.08	BDL
BDL		0.1	BDL	
BDL		BDL	0.26	
		0.01	BDL	
		BDL	0.02	
		BDL	BDL	

*BDL means below detection limit.

Step 1. Estimate the proportion above detection in the background wells. As shown in Table 8-2, there were 24 samples from background wells analyzed for cadmium, so n= 24. Of these, 16 were below detection and x = 8 were above detection, so P_u = 8/24 = 0.333.

Step 2. Estimate the proportion above detection in the compliance wells. There were 64 samples from compliance wells analyzed for cadmium, with 40 below detection and 24 detected values. This gives m = 64, y = 24, so P_d = 24/64 = 0.375.

Step 3. Calculate the standard error of the difference in proportions.

$$S_D = \{[(8+24)/(24+64)][1-(8+24)/(24+64)](1/24 + 1/64)\}^{1/2} = 0.115$$

Step 4. Form the statistic Z and compare it to the normal distribution.

$$Z = \frac{0.375 - 0.333}{0.115} = 0.37$$

which is less in absolute value than the value from the normal distribution, 1.96. Consequently, there is no statistically significant evidence that the proportion of samples with cadmium levels above the detection limit differs in the background well and compliance well samples.

INTERPRETATION

Since the proportion of water samples with detected amounts of cadmium in the compliance wells was not significantly different from that in the background wells, the data are interpreted to provide no evidence of contamination. Had the proportion of samples with detectable levels of cadmium in the compliance wells been significantly higher than that in the background wells this would have been evidence of contamination. Had the proportion been significantly higher in the background wells, additional study would have been required. This could indicate that contamination was migrating from an off-site source, or it could mean that the hydraulic gradient had been incorrectly estimated or had changed and that contamination was occurring from the facility, but the ground-water flow was not in the direction originally estimated. Mounding of contaminants in the ground water near the background wells could also be a possible explanation of this observance.

8.1.3 Cohen's Method

If a confidence interval or a tolerance interval based upon the normal distribution is being constructed, a technique presented by Cohen (1959) specifies a method to adjust the sample mean and sample standard deviation to account for data below the detection limit. The only requirements for the use of this technique is that the data are normally distributed and that the detection limit be always the same. This technique is demonstrated below.